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# Motorship

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**McINTOSH & SEYMOUR DIESEL ENGINES**

McIntosh & Seymour Corporation
Auburn, N. Y.

MAY, 1927

PRICE 35c.

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# Motorship

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# Motorshipping Marks New Era in Sea Transportation Business*

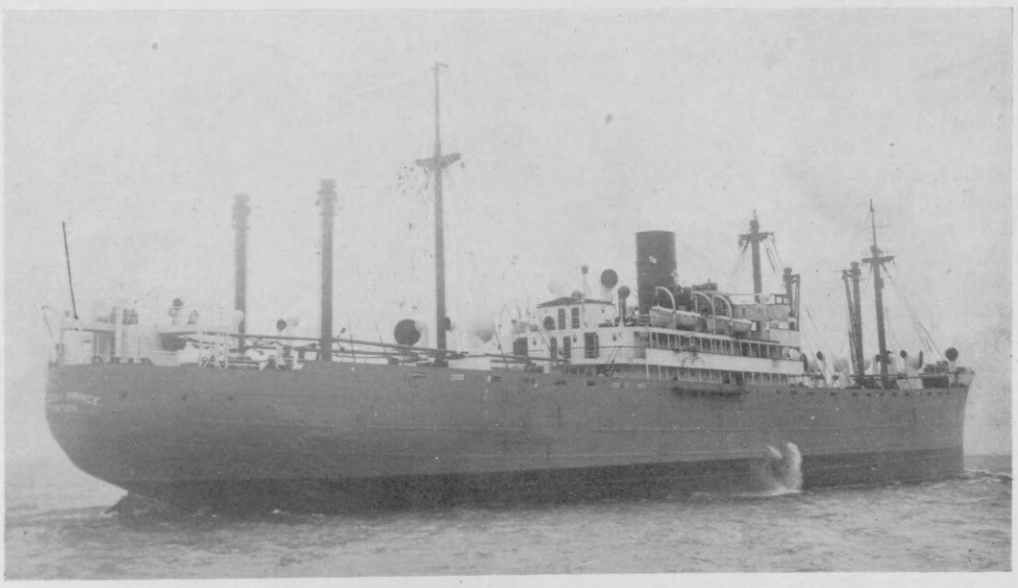
## Freight Ships Are Not Making the Best of the Diesel, but There Is a Slow Tendency to Evolve a New and Improved Arrangement of Holds, Decks and Machinery

ANY student of motorshipping who has followed, even cursorily, the developments of the last 10 or 12 years, must realize that the motorship, as we know it today, is tending to depart more and more from stereotyped steamship practice as regards general arrangement. On most up-to-date, well designed motorships—particularly cargo carrying ships—it is evident from an introspective feature-analysis of the design that new thought has been brought into play.

Particularly this makes itself felt in the rearrangement of superstructures, better distribution of cargo handling gear, new ideas on prime motive forces for driving auxiliary machinery and plant. Furthermore, this better arrangement is now being copied by those steamship owners whose conservatism withholds, or whose very special service requirements forbid, the use of Diesel propelled tonnage. In this we see the motorship definitely as an agent whereby all round improvement in ship construction technique is affected.

In a word, the stage has been reached where the motorship has become a definite entity. This marks a step of evolution, as important as it is significant. It shows that the majority of people are coming to realize what a very few people have realized all along, that a ship and its Diesel propelling machinery are one, each an integral part of a homogeneous whole; that it is fundamentally incorrect to take some given hull A and some given Diesel engine B which happens to fall within even 5n per cent of the powering requirements, fit one within the other, and call the result a motorship. The result is a motorship but not a 100 per cent successful motorship on competitive services.

Mistake not that this is a definite attack upon the conversion policy which so many owners have, throughout the history of motorshipping, been forced to adopt. Conversion is a necessity, and when carefully planned and executed has given excellent results, but it is here submitted that it is a procedure marking a transition period in motorshipping history.



*Fast 14½ knot motorfreighters cater to present day shipping requirements*

Those of us who are ardent advocates of the Diesel engine may regard it as flattering to our beliefs that it should be found necessary to reconstruct so much existing steam tonnage. Engine builders, too, welcome every conversion as additional "grist to the mill." Conversion is, first and last, however, a transition-period business and in another 15 or 20 years will practically have ceased. It is really an entirely separate branch of the motorshipping industry and may well merit separate discussion.

In what follows, we are concerned with a consideration of the motorship "as is," and more particularly with the cargo carrying motorship. Changes in layout of passenger vessels propelled by Diesel engines must naturally come more slowly but there are signs of very radical changes in the near future now that the realization has been borne in on people that the motorship, as well as being fundamentally superior, is also fundamentally different. The passenger ship well merits separate consideration.

While it is, perhaps, invidious to single out any one firm of ship or engine builders for special attention, it is impossible in a study of this nature to avoid mention of the wonderfully constructive work done by the Danish firm, Burmeister and Wain, in the direction of original thought on the provision of an arrangement for the motor cargo ship superior to that of the steamer. Having constructed the first big, ocean-going motorship, the now historic SELANDIA, back in 1912, and having devoted their plant exclusively to the construction of Diesel driven craft ever since, it was perhaps natural that they should have thought along original lines and impressed these ideas upon builders.

At the best, of course, the shipbuilder can only hope to advise the owner as to the layout of his ship. The owner generally has his own fixed ideas on the subject.

*First of a series of specially prepared articles written for those who desire a concise summary of the motorship in relation to sea transportation.

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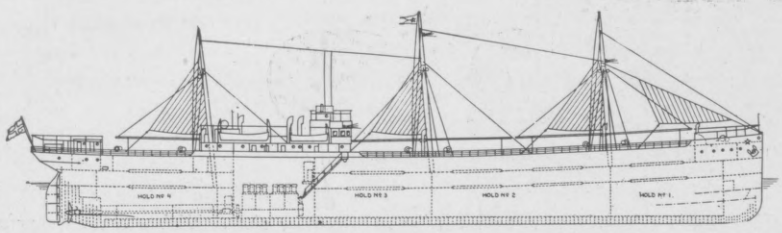
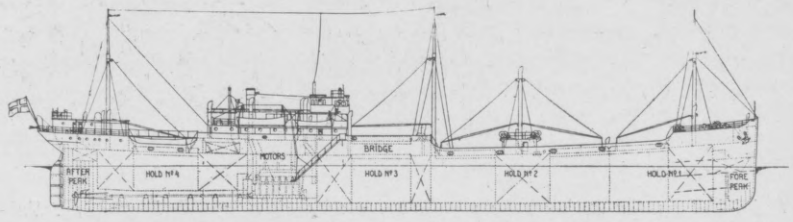


*Shelter deck motorship with new type superstructure*



*Arrangement of winches and superstructure on ms. Borgestad*

This accounts for the fact that some of the early concepts of economical arrangement are only now becoming to be generally recognized. It is worthy of consideration, however, that as early comparatively as 1912, the well known Danish firm completed a 3731 tons gross cargo ship for Swedish owners, which, in her main features, is comparable with best thought on arrangement at the present day. Remember, too, that at a time when most people were still fooling around with steam deck gear, Danish ships were using electricity for that purpose.

Let us now consider best practice in layout in more detail. The most obvious development of recent years has been the rearrangement of the two deck structures which in very many ships at the present time have quarters, respectively, in the one for the navigating officers, passengers if any, captain and chart and wheel houses, and in the other—in side houses round the machinery casing—quarters for the engineer officers. The arrangement of having two houses is still considered satisfactory by many owners and designers but progressive modern thought tends to combine the two structures in one. As a very good example of which attention may be drawn to the illustration of the superstructure of the German Kosmos freighter ISIS of 7200 tons dw. This ship has a 2-deck, superstructure with a bridge and wheelhouse structure at the forward end. She is a well decked ship, the well being forward, and has four cargo holds, three forward of and one abaft the machinery.

Contrast this with the older arrangement—the steamer arrangement we may call it—in which the machinery is generally amidships and the holds are distributed evenly on either side. The Diesel engine permits of a small compact machinery space in which it is perfectly feasible to arrange the machinery quite well abaft amidships. This will be even more compact, when tonnage measurements are regulated to be fair to the motorship.

This is definite progression away from the steamer, marking step in evolution, and showing that the motorship is no longer being considered as a steamer with a different type of prime mover.

Opposite are tables, one showing the number of holds, deadweight tons and structural type of three modern-thought motorships, the other showing diagrammatically the position of the holds with respect to the machinery space. This latter bears out our hypothesis.

The structural rearrangement we have shown above is, of course, possible in certain types of steamer, but it is not generally adopted except in the larger types of freighters. Furness-Withy & Co. use it on their 11000 ton turbine driven cargo vessels of LONDON MARINER type, but this structure is a long one and has accommodation for passengers in addition.

*Atlantic Refining Co.'s new tankers*

### Feature-analysis of Modern Motorships

TONNAGE AND TYPE

| SHIP NO. | DEADWEIGHT TONS | STRUCTURAL TYPE | NO. OF HOLDS |
|---|---|---|---|
| A | 10,000 | Shelter Deck | 6 |
| B | 6,500 | Shelter Deck | 4 |
| C | 6,775 | 3-Island | 4 |

DISPOSITION OF HOLDS AND MACHINERY

| | A | B | C |
|---|---|---|---|
| Length b. p. 440 ft. | Fore Peak | Fore Peak | Fore Peak |
| | Hold | Hold | Hold |
| | Hold | Hold | Hold |
| | Hold | Hold | Hold |
| | Deep Tank | MACHINERY | MACHINERY |
| | MACHINERY | Hold | Hold |
| | Hold | Aft Peak | Aft Peak |
| | Hold | | |
| | Aft Peak | | |
| Length b. p. 362 ft. | | | |
| Length b. p. 350 ft. | | | |

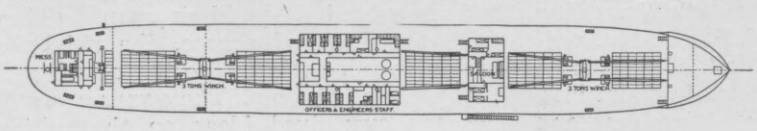
*New style superstructure on German ship*

With a long structure on the shelter deck on a large ship you can make a perfectly reasonable arrangement without any complications due to boiler uptakes but on a small ship such an arrangement is more difficult. With the motorship on the other hand the "uptakes" are reduced to a small casing sufficient to take the one or two main engine mufflers while the auxiliary engine mufflers can be, and frequently are, arranged horizontally underneath the main deck.

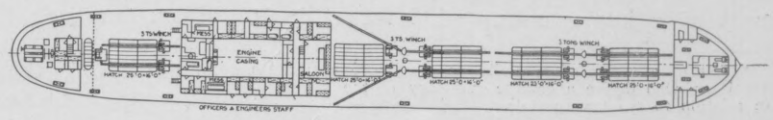
Example C in the table above is the B. & W. built and engined BORGESTAD, whose "house" in the remarkably reasonable length of 70 ft. contains accommodations for the whole of her staff. The accommodation structure has the navigating bridge at its forward end but does not carry quarters for the crew.

The old steamer-type arrangement inevitably placed a hatchway between the deck officer's house and the engineer officer's side house, which may be perfectly logical arrangement for certain types of heavy general cargo but which is not, logically, good practice for ships engaged in the grain or other bulk cargo trades where facility for ready movement to and fro under loading spouts or unloading apparatus is desirable. The ideal actually for *all* ships of this type is to place the machinery aft leaving a clear sweep of deck forward which speeds up cargo handling 100 percent. It is actually not always possible of attainment, however, on ocean-going ships. This arrangement reaches its most extreme form in the big bulk freighters on the Great Lakes and on these ships also you get extreme separation of navigating accommodation and engineering accommodation. The extreme length of the structure of the hull—some 600 ft. in the case of the large freighters—makes this imperative, as it would be very difficult to navigate safely, in comparatively restricted, crowded waterways, from the aft end of the hull. Great Lakes ships, are nearly always "coasting" and navigating by shore marks, but for ocean-going ships it is immaterial where the navigation is carried out from, while the ship is engaged in ocean navigation.

Under these circumstances, on the modern motorship, the whole thing is taken care of by the "metal mike" and the long distance radio d. f. set, and the actual "bridge" space required is reduced to a minimum. It is probably this thought that has induced Atlantic Refining Co. in its three Diesel electric ships—conversions from steam and improvements on their existing Diesel-electric ms. J. W. VAN DYKE—to remove the navigating officers structure and house with the pilot house from its stereotyped position 'midships aft on to the poop. This is a distinctly progressive thought which Diesel-electric drive and modern electro-navigational devices alone have made possible. The ships in question have a length of just over 360 ft., which



*Single superstructure makes for clear decks*



*Older steamer-type superstructure*

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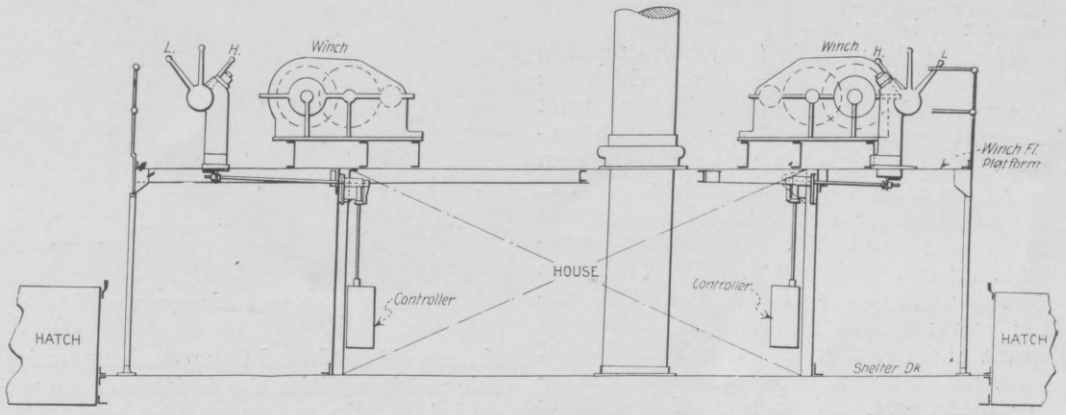
does not rule out navigation from aft under even coastwise and approaching-port conditions. Even the largest tankers will have no difficulty in using repeat navigating appliances forward for intricate navigation once the flexibility of marine Diesel electricity is realized more generally.

In fact no review of the structural alterations the Diesel engine has brought about can hope to be complete without considering the effect which the increasing use of electricty has had also. We have seen how the generally smaller engine casing needed, together with the absence of boiler uptakes has made possible the bunching together of two superstructures into one. This was a result of the Diesel engine application only and has taken some 14 years after the date of the completion of the first motorship of ocean-going type to come to fairly general use. Note, however, that Danish ships were being constructed this way as far back as 1914.

"Diesel-electricity," for auxiliary purposes, was born with the motorship in Denmark and grew up in Denmark, and in the Harland and Wolff plants in Great Britain. It was not treated enthusiastically in countries other than America. This country has now probably a keener sense of the potentialities of marine-electricity than any other country in the world. The motorship with steam auxiliaries is a hybrid arrangement as uneconomical as it is unnecessary, at the present time, except, perhaps, on very specialized ships like tankers. We do not need to play for safety in the marine Diesel engine game today. The cry is "Reduce Weight and Costs." The modern motorship, then, is electric in everything but her main propelling machinery. What effect has this on arrangement?

Since we are not concerned here so much with engine room arrangement as with deck and hull equipment, it is natural first to turn to deck machinery. All Shipping Board reconstructed motorships completed under the first part of the programme were 3-island ships. The whole of the deck machinery was electrified and advantage was taken of the electrification to raise the winches on platforms round the mast in each well as the illustration shows. While it cannot be pretended that the arrangement is a novelty—it has been in use on Scandinavian steamers and motorships for some years—its efficiency is even more potent in the case of an electrical winch arrangement.

The raised platforms keep the winches and winch operators clear of hatch beams, hatch covers and miscellaneous litter piled on the deck in port and raise the winches above the water that slops back and forth over the deck when seas break over the




*New thought arrangement of winches on house top clear of deck*

quarter. Motors may be totally enclosed and winch gears encased in oil covers, but water is better kept away from them, particularly water than can splash up from the base. Occasional seas will break over them on their elevated stand and they are subject to spray and rain—and that is enough. A motor of watertight design may not be watertight after an overhaul by shore electricians.

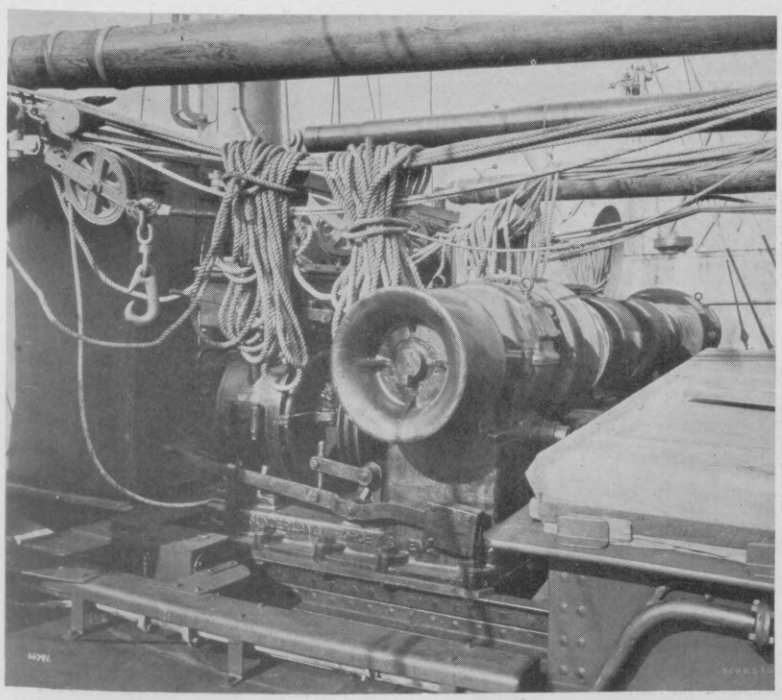
Contrast the arrangement with the bunching together of four winches in the cramped space between two hatches and round the base of the mast, shown in the illustration. This particular ship is a so-called modern motorship of shelter deck type constructed in 1926 which actually is modern in her main and auxiliary machinery only. Elsewhere she typifies conservative steamship layout.

British shipyards are inclined to be somewhat guilty in this direction and the general arrangement of some motor cargo vessels built in Great Britain represents a surprising lack of constructive thought outside the engine room. This remark does not apply to the magnificent vessels owned by some of the big shipowners engaged in long distance ocean hauls.

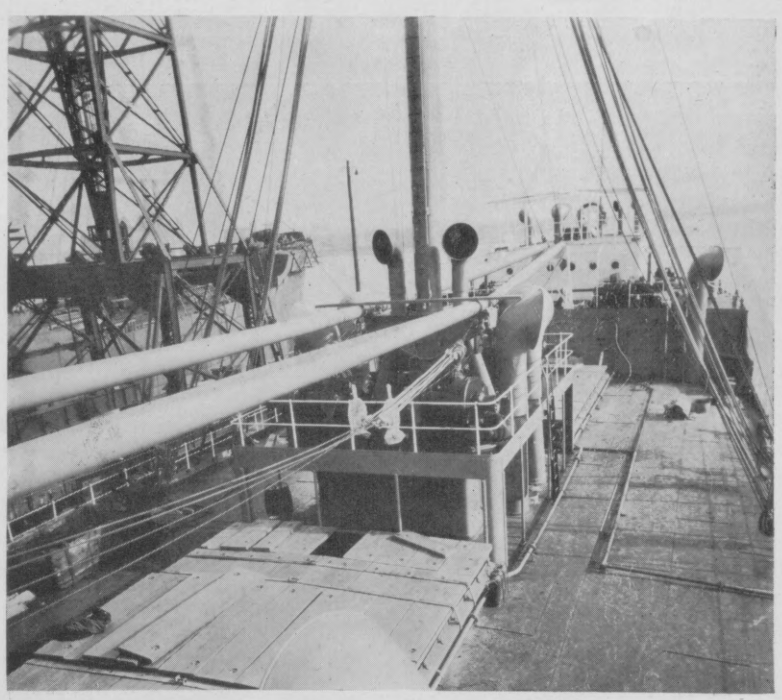
It leads one, however, to emphasize the fact that shipowners and their advisers do not realize the *basic* difference between the steamer and the motorship. It is only a thorough appreciation of the basic difference which enables an owner to get the best out of his motorship.

The existing tonnage regulations, of course, do not help the motorship and the ideal, compact motorship engine room will never be attainable until the present steamship-era rules are altered. With a minimum engine space, still further modifications may be made in general arrangement and in superstructure. This "converted-steamer" attitude has done a great deal of harm to the motorship cause as a whole.

Returning now to a consideration of the Shipping Board Conversions, we find on examination of the drawings, that the winch control on the winch platform is connected with a link system which enters the controller space through a stuffing box. Its arrangement can be followed very clearly in the drawing. The winch operator asks only for a handle to control his winch,



*Notice these winches crowded between the hatch ends and mast base*



*Notice here the winches high up and clear of deck obstructions*

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and if it works freely without sticking and gives him a sufficient choice of speeds he is satisfied. Where the controller is, he does not even consider.

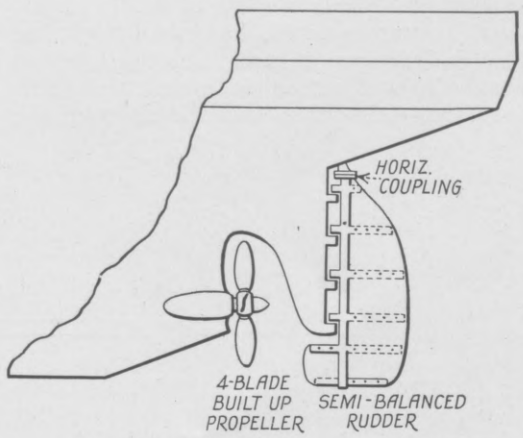
Locating the controller, panel and resistances in a space that protects them from the weather, permits them to be properly ventilated during use and keeps them in good operating order, ready always for hard service in port and without repair bills. If they are, on the other hand, kept outside, no matter how well they may be encased, their condition is jeopardized by the human factor, the best of watertight boxes not being always firmly closed.

The new thought in the arrangement is expressed right in the controls which are away from the winch itself. Does this not forecast some system of remote winch control? The only reason for putting a man alongside a winch is because hitherto—i. e., before the advent of electricity—he could not be anywhere else. You can't have remote control with steam. The winchman doesn't want to superintend the actual piston movement of his winch. He has to watch the hoisting and derricking, or at least he does this through the intermediary of helpers. If he himself is looking down into the hold and over the ship's side . . . why not remote control for that purpose at hatch or at ship's side?

We can hardly begin to appreciate the flexibility of operation which all types of electric appliances on shipboard will give. Even the electrical specialists are inarticulate in the matter because they are only just beginning to sense their potential field and what it will mean.

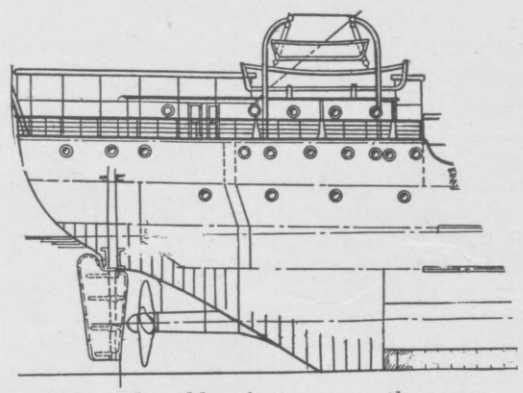
After all, steering from pilot house is remote control, and as such is taken for granted without a murmur. Here again, the advent of the motorship has brought into prominence such refinements as the gyro-pilot or "metal mike," electric course recording instruments, revolution indicators, etc. Owners now realize that the motorship *per se* is a finer instrument of transportation which performs a given duty more cheaply and effectively than the steamer. They are beginning to realize, too, that the more refinements, within reason, they put in such vessels, the better will the ships do their work.

To quote one example of this, there is the stern arrangement below, fitted to a recent motorship. A 4,000 hp. double-acting 4-cycle Diesel and is direct connected to a 4-blade built up propeller running in a part stern frame aperture of the special type illustrated herewith in the sketch. The




*Special stern on modern motorship*

absence of deadwood is particularly noticeable and in addition the designers have succeeded in eliminating all portions of the



*Balanced rudder features another new arrangement*

stern frame of stereotyped outline, which while necessary, maybe, for strength considerations are simply adding to the total resistance of the ship. Thus actually the new arrangement shows a stern frame without bottom and part of the back—in effect an arrangement somewhat reminiscent of that adopted when the Flettner rudder is fitted. The cutting away of a certain amount of deadwood too, and the semi-balanced rudder should improve the steering.

A similar arrangement to the one shown above is also seen in the preliminary arrangement of a fleet of four 14-knot motor freighters, shortly to be constructed for the Rotterdam Lloyd Company, Rotterdam. These ships have a deadweight capacity of just over 9,000 tons and a speed of 14 knots with 5,000 s.hp., given by different types of 2-cycle Diesels.

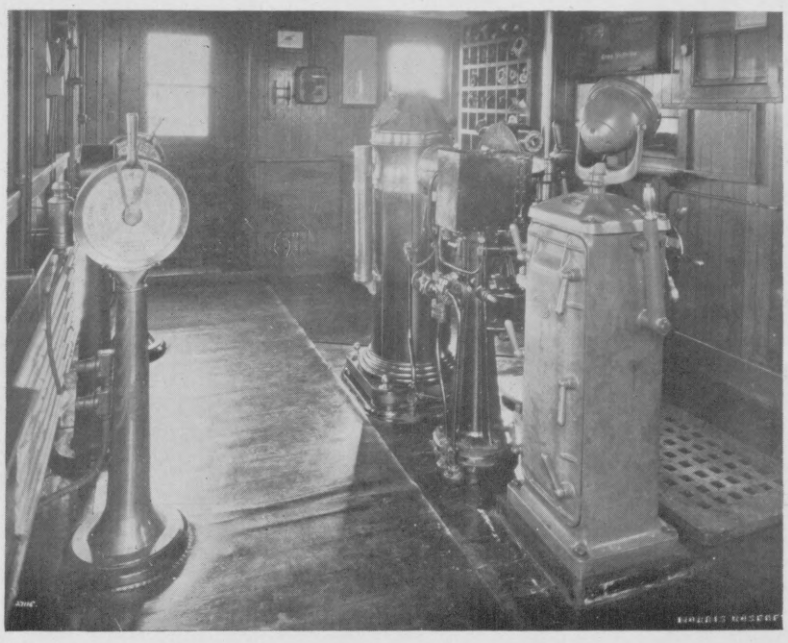
The stern is of full cruiser type and is characterised by a sharp rise (almost 45 deg.) of keel aft. A narrow balanced rudder, reminiscent of torpedo boat destroyer "spade" type, is arranged immediately aloft a 4-blade built-up propeller, operating at from 90 to 95 r.p.m.

Examination of a number of structural designs of modern motor cargo ships shows that the older types are, in the main, being adhered to, with the modifications and refinements we have sketched briefly above. If there is a tendency at all, it is towards the shelter deck type. Especially in Far Eastern cargo trades, this type is almost a necessity with two or three 'tween decks. Where certain bulk trades are in consideration the three-island type is bound always to have much to recommend it, particularly if deck loads are to be carried.

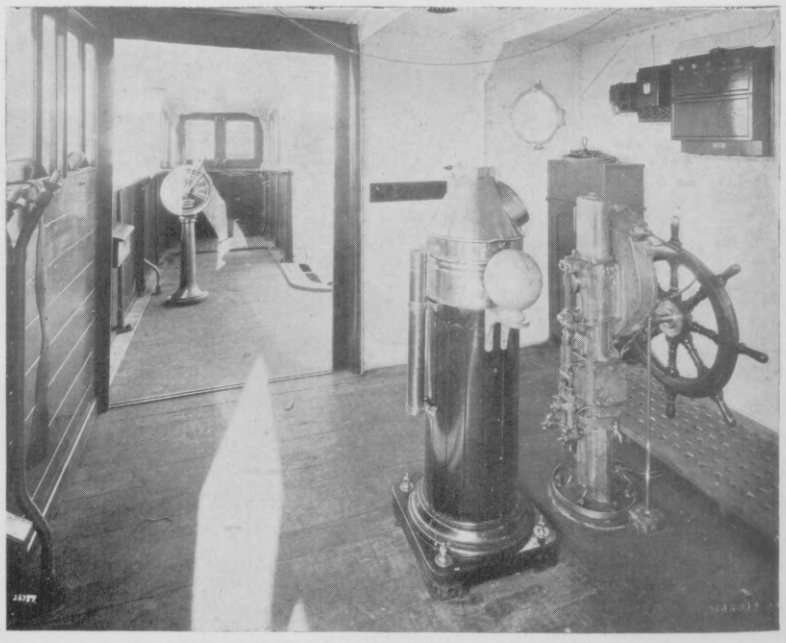
One interesting case of alteration of structure with two similar ships may be cited in the case of the sister vessel BORGESTAD, and BRYNJE. MS. BORGESTAD is a three-island freighter with a short bridge erection and small well deck aft as the illustration shows. The forward well is an extremely long one taking in three hatches (No. 2 hold has two hatches). No. 4 hatch is trunked up to the bridge deck. The winches for Nos. 2 and 3 hatches are arranged on a winch house in the forward well, while for No. 1 hatch they are arranged at the break of the forecastle, leaving clear decks as is usual in good practice.

The sister vessel MS. BRYNJE has the bridge extended forward of No. 3 hatch.

We cannot dogmatize in structural types; we can only insist on the all round superiority of the motorship as an instrument of transportation.



*Pilot house with electro-navigational equipment*



*Conservative type of pilot house with old time binnacle*

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# Sixteen More Conversions Are Planned

## Dieselization of Shipping Board Tonnage to Be Continued to Provide Big Modern Fleet for Ocean Trade Routes

COMMISSIONER BENSON has been authorized by the Shipping Board to submit recommendations for the Dieselization of a further fleet of from 12 to 16 cargo vessels, which will bring the board's Diesel fleet up to a maximum of 29 vessels of modern type.

The new program will apply to ships of from 9,000 to 12,000 deadweight tonnage, and immediate action on this plan is contemplated by the board. Seven motor ships are now in operation and contracts for installing Diesel engines in a further nine are already under way.

A $400,000 contract for installing motors in the YOMACHICHI has been awarded to the Newport News Shipbuilding and Drydock Company; a $410,000 contract for the WEST GRAMMA has been awarded to the Bethlehem Shipbuilding Company, and a $36,000 contract has been awarded to the Todd Shipbuilding and Drydock Company for Dieselizing the SEMINOLE. These vessels will not have passenger accommodations.

### Plummer's Recommendations

Vice-Chairman Plummer, after his return from a trip to the east coast of South America, recommended that some motorships be detailed immediately to the American Republic Line, which operates ships to South American ports. The board, however, decided to allocate what motorships were available to the Australian line on account of its longer haul and then to take care of the South American Line. The first results of the Dieselization program of the U. S. Shipping Board are being witnessed in the success of the six vessels now in service on the Australian run.

American participation in Diesel engine and motorship construction has been limited by the same forces which have limited the construction in American yards of ocean-going vessels of all types. To build ships in the United States for operation in foreign trade costs from 25 per cent to 30 per cent more than such construction does abroad, because of higher material and labor costs. The same higher costs affect the cost of operation under the American flag, and, in addition, the cost of insurance is greater in the United States. What has been accomplished, therefore, has been through the Dieselization program of the Government. Under it the Shipping Board is authorized by Congress to spend amounts totaling not more than $25,000,000 on the conversion of steamers built during war time to motorships.

The first selection of vessels contemplated the conversion of 14 ships. Two of these were dropped from the list, so that 12 will be completed. Half this number are already in service and the rest are well along the way. When all are completed the expenditure from the special fund will be in the neighborhood of $8,000,000 to $10,000,000 leaving upward of $15,000,000 yet available for modernizing tonnage.

The vessels which have been converted to motorships are the TAMPA, UNICOI, WEST HONAKER, WEST CUSSETA, SAWOKLA and CROWN CITY. All have been given rigid sea trials and have proved themselves satisfactory for heavy duty. In the case of nearly all but the WEST CUSSETA, the maiden voyages of the vessels as motorships have been over short routes, such as the transatlantic run. Ms. WEST CUSSETA, however, was put directly on the Atlantic-Australian service and completed her first voyage from New York to Sydney in 36 days without mishap and without any cost for repairs. Eventually, all six of the ships will be placed in the Far Eastern services and it is planned to put other Dieselized boats in the long-voyage services as soon as conversion is accomplished. The maiden voyage of the SAWOKLA was to Buenos Ayres and return.

### Diesels Operate Cheaply

One of the greatest advantages gained by the Dieselization of these ships is greater speed. Yet, of almost greater importance is their much lower operating cost as motorships as compared with steamers. By the substitution of the Diesel engines for the steam engine, the firemen necessary in steam operation are eliminated. Operation of the Diesel engine is regarded as a highly skilled occupation and a premium wage is paid engineers who successfully pass the tests requisite to securing this type of employment.

Another big item of economy is the saving effected on fuel. The Diesel engine operates on about one-third of the amount of fuel required by the oil-burning steam engine. The capacity of tanks in the Board's Dieselized ships gives them a cruising radius almost equal to the circumference of the world, so it is possible that oil enough for a round-trip for the New York-Far Eastern run could be bought wherever the oil is cheapest.

Ms. TAMPA, which was the first to be completed as a motorship, was given a sea trial and then loaded at Savannah with cotton for Bremen, Germany. She completed the round voyage at New York with a miscellaneous cargo. During the voyage, a careful check on revenues and operating costs were kept, and it was noted at the close that a marked saving in favor of the motorship had been effected as compared with average voyages of steamers of the identical size and design. Trial trips and initial voyages have indicated that the other motorships are equally as efficient.

An important feature of motorship operation is the almost total absence thus far of need for engine repairs. These costs for steamers have always been heavy and ship engine repairers, especially those in distant ports, have flourished for years at the expense of the shipowners. It is usually the case that the owner is in a hurry for the ship and is at the mercy of the repair man. Consequently, the repair bill is apt to be high, although it may not be wholly justified in view of the extent of the damage incurred while at sea. The cost of repairs to steam cargo vessels averages around $3,000 per voyage. Sometimes this cost represents the margin between profit and loss, and to reduce it through Diesel operation greatly enhances the possibilities of successful operation under the American flag.

The speed which is maintained by the Dieselized fleet runs fro m11½ to 12 knots. This speed is to be compared with speeds of 10 or 10½ knots, of which the vessels were capable as steamers. On an 11,000-mile run, such as that between New York and Sydney, this makes a difference of from 5 to 7 days at sea and presents far greater attraction to the shipper.

### Improved by Conversion

The general character of the Dieselized vessels has been improved by the conversions, and the decreased quantity of oil burned make it possible to carry less fuel and this has increased the deadweight cargo-carrying capacity of the vessels about 300 tons. Each of the ships has been given a thorough overhauling and accommodations for 11 or 14 passengers have been installed. The accommodations are located in the same relative position on the cargo boats that are occupied by the most expensive suites and staterooms of the high-class passenger vessels. All of them are light and airy, affording good means for comfortable travel. They have been installed particularly to fill the needs of American manufacturers who are sending goods to far-away markets. It is often the case that shipments of machinery, electrical, or other mechanical equipment, are most successfully completed if a manufacturer's representative is sent to superintend handling and installation of the goods. With the accommodations provided on these boats, this is easily effected. Without them, the representative is forced to undergo the hardships of ordinary cargo ship travel, or else go by passenger vessels, generally by more circuitous routes, with one or more changes, where he would really gain nothing in the way of speed in transit.

The purposes of the Government's motorship program are twofold: Primarily, it is intended to give the American Merchant Marine a nucleus around which a modern fleet can be constructed, and to bring at least some of the American lines to a positon in which they can compete effectively with the ships of other flags. Secondly, it is purposed to stimulate the design and manufacture of Diesel engines by Americans, and to develop skilled workmen and Diesel engineers among citizens of the United States.

The Dieselization program may be continued by the Board until all of the funds available have been utilized. The $15,000,000 yet unpledged is enough to provide at least 20 to 25 more motorships.

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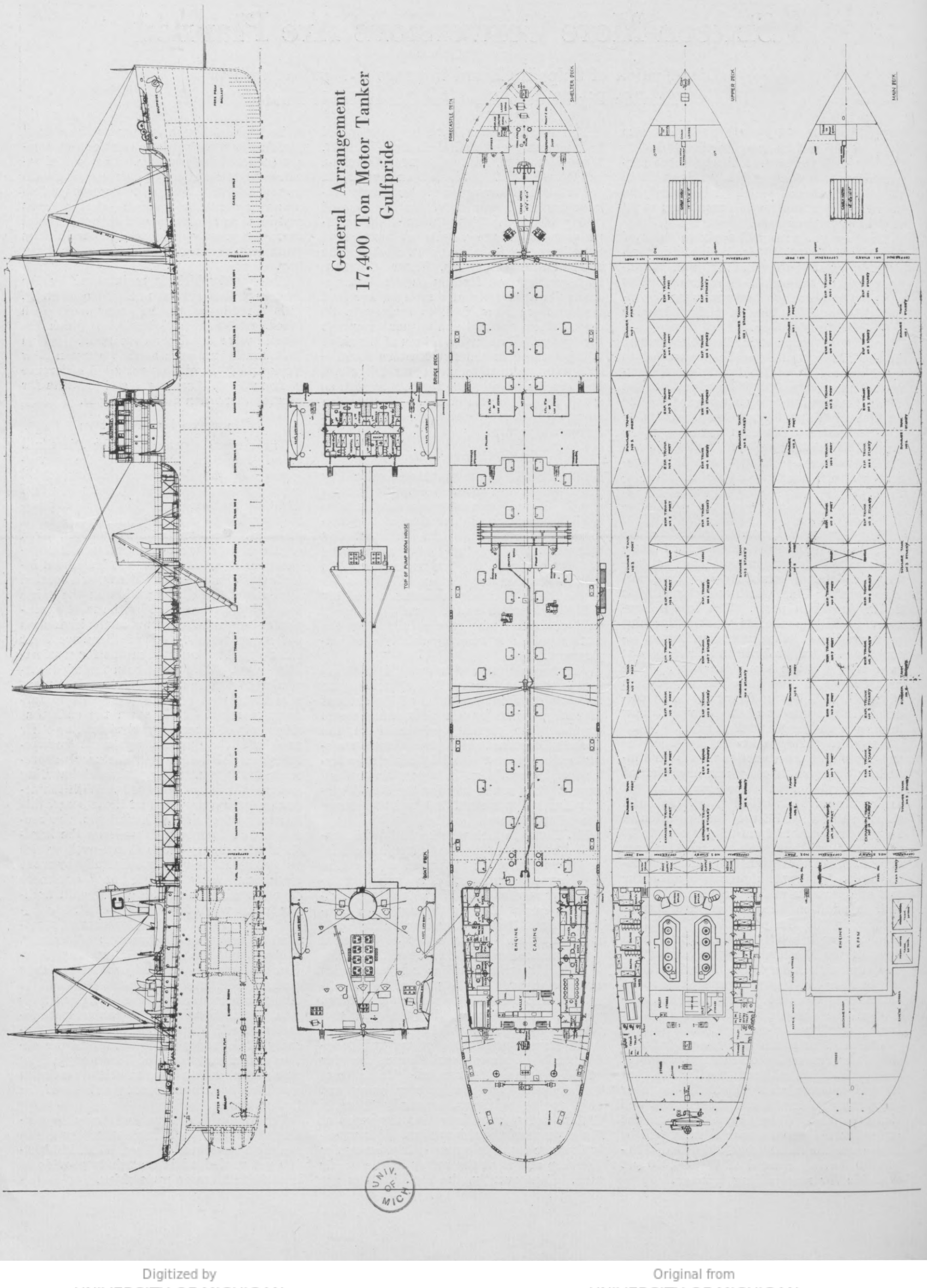
# General Arrangement 17,400 Ton Motor Tanker Gulfpride

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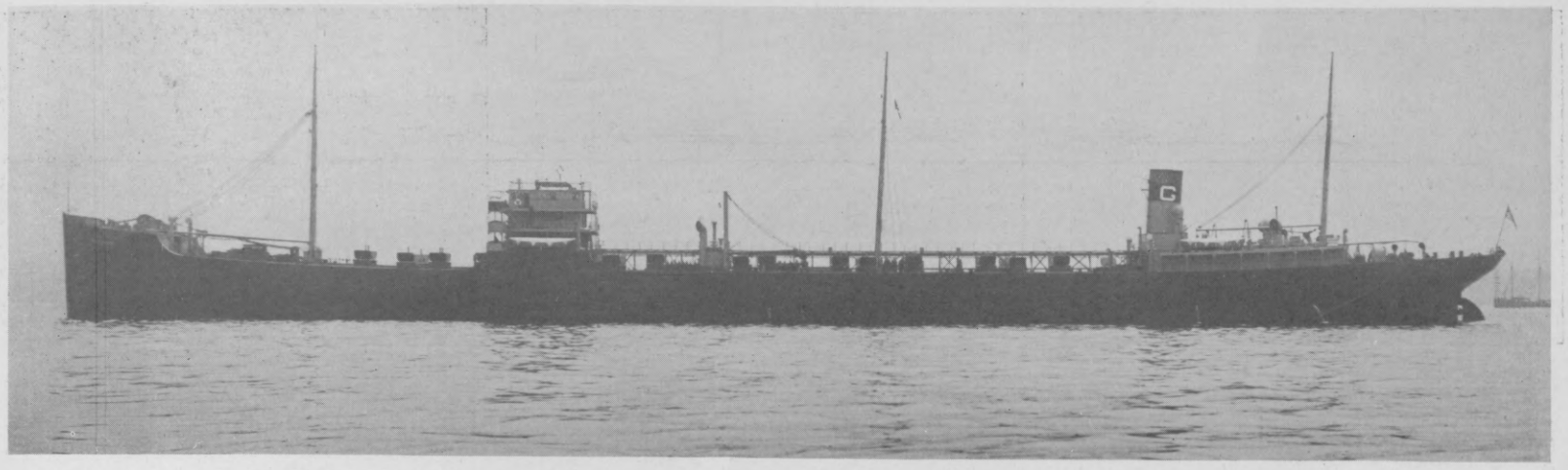

# Gulfpride, America's Largest Motorship

## Federal Shipbuilding Company Completes 17,400 Tons Isherwood Bracketless Tanker, Powered With Twin Bethlehem Diesels

MS. GULFPRIDE, 17,400 ton dw. tanker which left her builder's yard late in March and is now in the coastwise service of her owners, the Gulf Refining Company, is unquestionably the most noteworthy vessel to be completed in an American shipyard for some time. Indeed she takes her place as one of the most important motorships to be completed in world shipyards during the present year. She is the first American oil tanker to be

*"Metal mike" in pilot house*

constructed on the Isherwood Bracketless system of longitudinal framing, and she is also the largest motor vessel and the biggest tanker constructed in American shipyards to date.

GULFPRIDE is a twin screw motor tanker with machinery aft in the conventional manner for such ships. The hull is divided by 17 watertight and oiltight transverse bulkheads—the forepeak, forward hold, cofferdams, 10 bulk oil tanks, pump room, fuel oil tank, machinery space, and aft peak. The forward hold is arranged for carrying oil in barrels by fitting a watertight deck between the main and the shelter deck in this part of the structure.

The hatch covering to this hold is a steel hinged cover and reflects gratifyingly progressive thought in this direction, showing that owners of up-to-date motorships are gradually beginning to realize that they cannot be obsolescent in such minor details as hatch covers. The old-time wooden hatch is as dangerous as it is inefficient.

The shelter deck extends to the stem and the foc'sle forms a store room over the fore peak deck. This is 7 ft. 6 in. in height and contains in addition a carpenter shop, lamp room, and paint room.

### Characteristics of MS. Gulfpride

| | |
|---|---|
| Length b. p. | 525 ft. 0 in. |
| Breadth mld. | 74 ft. 0 in. |
| Depth to shelter deck | 40 ft. 6 in. |
| Bulk cargo capacity | 16,700 tons |
| Draft (load) | 28 ft. 0 in. |
| Speed (trial) | 11 knots |
| Capacity main cargo tanks | 672,000 cu. ft. app. |
| Capacity of summer tanks | 159,000 cu. ft. app. |
| Power main engines | 2000 s.hp. |

There is a center line bulkhead in the oil tanks, extending from the keel to the shelter deck and expansion trunk bulkheads, one port, and one starboard extending from the main to the shelter deck. The wing tanks outside the expansion trunk bulkheads are divided into five compartments on each side, fitted as summer tanks. The total capacity of the main cargo oil and summer tanks is about 16,700 tons of oil at 6.1 lb. per gal. The fuel oil cross bunker has a capacity of about 800 tons of fuel oil.

A steel house, forward of midships after conventional tanker practice, provides quarters for deck officers, quartermasters, radio operator, hospital, etc., while above this house are accommodations for the captain, gyro-compass room and battery room. A wood pilot house containing wheel house and chart room, with flying bridge above, is built over the captain's quarters. Aft, quarters are provided in the steel deck house and the 'tween decks for engineer officers, petty officers, remainder of the crew, galley and mess rooms.

The machinery space located aft, as has been mentioned, contains the two 4-cylinder 2-cycle single-acting Bethlehem Diesels. All the engine and auxiliary machinery with exception of the emergency compressor and two donkey boilers and feed pumps are electrically driven, power being supplied by Nlseco Diesel driven generator units. Steam for heating quarters, galley, engine room, etc., is supplied by two donkey boilers 7 ft. 4 in. diameter by 13 ft. high, with 1200 sq. ft. heating surface, each fitted for both fuel oil burning and

*R. C. A. Radio Compass*

engine exhaust gas burning when necessary.

GULFPRIDE has been built under special survey of the American Bureau of Shipping and Lloyd's Register for carrying petroleum in bulk with flash below 150 deg. Fahr. The machinery space is so arranged that the 32 per cent reduction for net tonnage can be obtained. For this reason it is considerably larger than would be necessary if tonnage rules as existing at present were favorable towards motorshipping. But the large space necessitated by the tonnage regulations has made possible practically an ideal layout of main and auxiliary machinery. The machinery cas-

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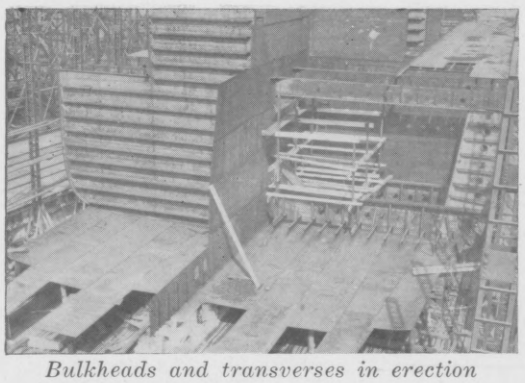
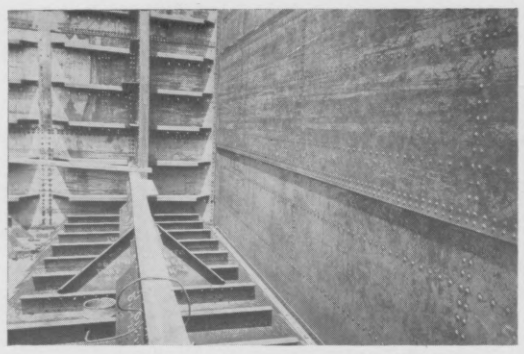
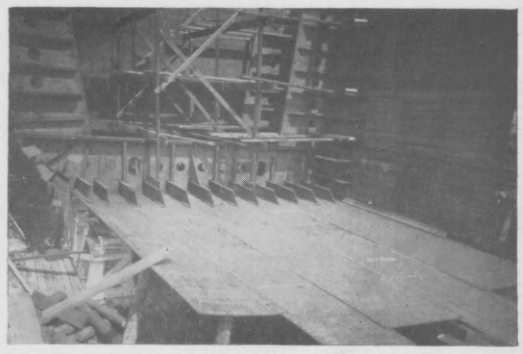


*Bulkheads and transverses in erection*



*Centerline and transverse bulkhead*



*Centerline bulkhead and a transverse*

*Constructional progress pictures of ms. Gulfpride, America's largest tanker, and largest Isherwood Bracketless ship*

ing is carried to a height of 7 ft. 6 in. above the shelter deck and a steel frame skylight is fitted over the casing.

The pump room is fitted between numbers 5 and 6 cargo oil tanks, and the trunk fitted from the main to the shelter deck is

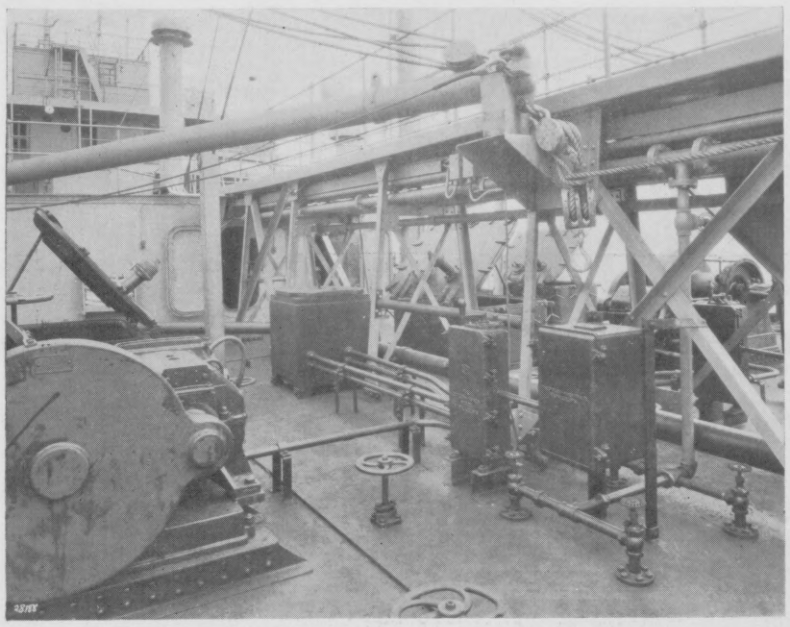
*Aft end of ship framing*

provided with a combined skylight and companionway hatch of steel in the shelter deck. The center line bulkhead is carried through the pump room with suitable openings provided for access to either side. There is also a gas and oil-tight steel enclosure for the forward ballast pump at the forward end of the fore hold, access to which is had from the shelter deck by a special entrance with watertight door under the forecastle.

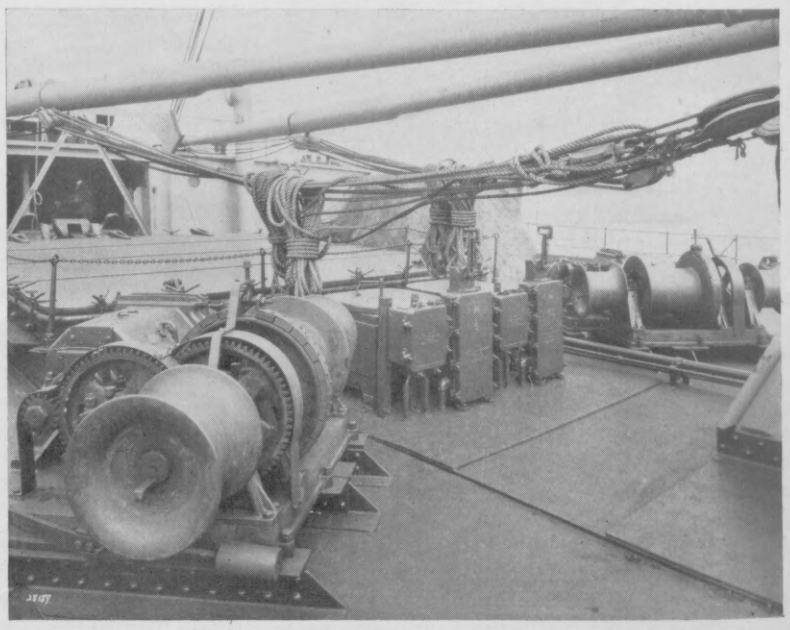
Control and access rooms for the main pump room are located at shelter deck level and the pump room contains two Worthington pumps for handling gasoline of 1500 gal. per min. capacity operating at 90 lb. per sq. in. pressure. There are also two wing tank pumps of 500 gal. per minute each, operating at the same pressure. The cargo pumps are located inboard and the wing tank pumps outboard. They are driven by Westinghouse 100 hp. motors of especially designed enclosed type, with Cutler-Hammer magnetic contactor type controllers having a speed of the normal operating speed of the pumps with about 10 running points of operation. These are installed in the control room at shelter deck level. The controller is provided with start and stop push-button stations for local and remote control. The pump motor controls are interlocked with a control for the blowers ventilating the motors.

Two Sirocco-type motor driven ventilation fans are located in the control room, one of which is an exhauster for pump room ventilation, the other being a blower for ventilation of the pump motors. Each fan has a capacity of 3000 cu. ft. of air per min. Each fan is driven by a 7½ hp. Diehl motor with Cutler-Hammer hand-operated starting panel. The exhauster is arranged to withdraw the vapors from the pump room and the holds through the main cargo oil suction pipe. The exhauster has a separate suction, having branches to the lower pump room, port and starboard, and to the main cargo oil suction pump with dampers at the exhauster and a valve at the suction pipe. It discharges to the atmosphere above the control room through a ventilator fitted with a damper. The exhauster is also arranged to act as a standby for the motor ventilation blower in case of emergency. In case of trouble with the blower motor, it can be uncoupled and the exhaust fan motor coupled to the blower

*Ship in frame to fore peak bulkhead*



*Controls for mooring winches aft of pump room*



*Dry cargo winches and steel hatch covers*

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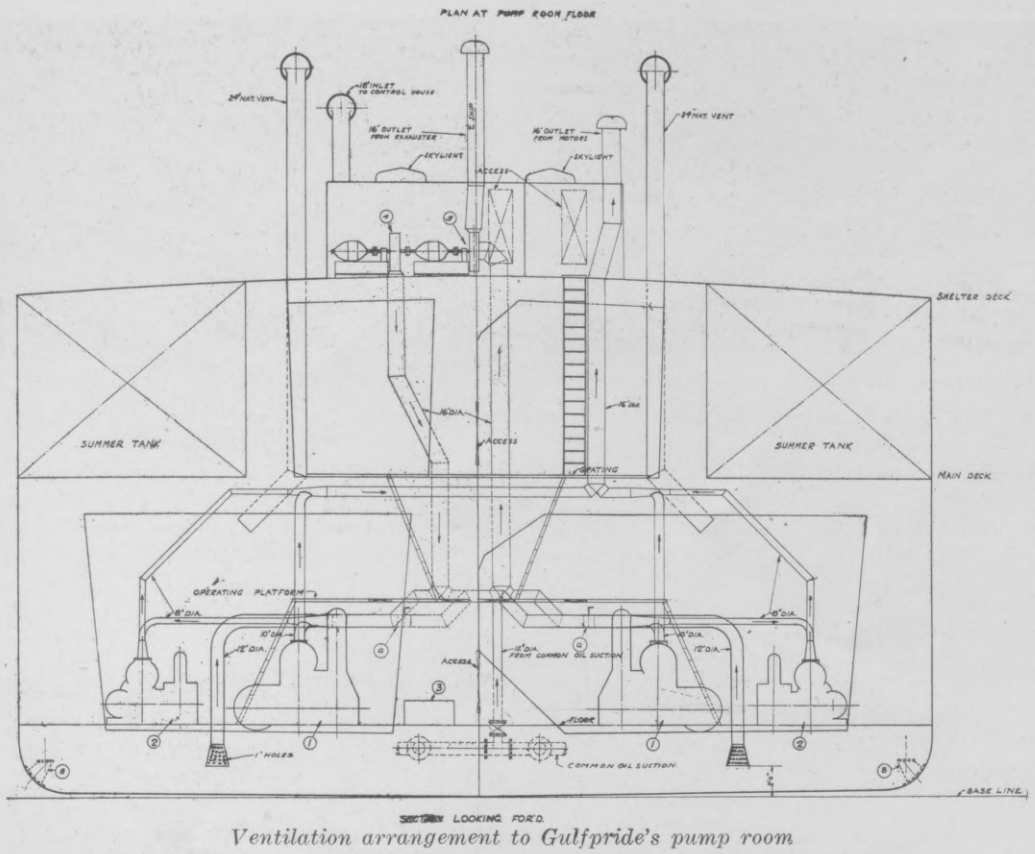


*Ventilation arrangement to Gulfpride's pump room*

fan. The two motors are exact duplicates and parts interchangable. When the exhaust fan motor is used for blower service a damper is closed in the pump room exhaust pipe. The blower draws the air from the control room and discharges to a header having branches to all four pump motors. A damper is fitted at the blower discharge. Outlets from the motors are connected to a header discharge to the atmosphere above the control room.

The GULFPRIDE is well fitted out with electric-navigational devices. She has a Sperry gyro-pilot and automatic steerer installed in the pilot house in connection with the steering control. A Sperry gyro-compass is also fitted comprising a master gyro, with necessary storage battery control panel and alarm unit, a steering repeater, and a bearing repeater.

The steering gear is of Hyde Windlass Company's hydro-electric type and consists of a 20 hp. Westinghouse motor operating a Waterbury variable stroke delivery pump. The pump is connected by piping to two hydraulic ram cylinders, the plungers of which operate a swivel bearing. The tillers are on the rudder stock. The pump is fitted with an automatic pressure regulator to prevent overloading of the motor.

Electric telemotor control is of Sperry type, fitted with automatic follow-up mechanism arranged to limit the travel of the rudder to 35 deg. to each side of the center line. There are two steering stations, one forward, located in the pilot house, and one aft, situated on deck.

In addition to the regular fire mains to the crew quarters required by the United States Inspection Service, a Lux system of fire protection is fitted to all cargo oil tanks, including summer tanks to the cofferdams, fuel oil tanks, lamp room, paint room, forward hold pump room, and machinery space.

This protection is exceptionally complete and a conflagration occurring in the motor room for example, can be smothered by filling the entire space of upwards of 130,000 cu. ft. of air space with a non-poisonous gas, released from steel flasks in which it is stored under compression.

There are two Hyde type single spur geared cargo winches of 4,000 lb. pull at 200 ft. per min. rope speed. There are also two mooring winches of similar make, a warping winch aft, and a windlass on the fo'csle.

# "Isherwood" Tonnage Increasing

MS. GULFPRIDE has been built on the Isherwood longitudinal system of construction used in a large number of tankers at the present time. Moreover the straight longitudinal system in this case has been superseded by the Bracketless System—the latest development of the Isherwood system. GULFPRIDE is actually the largest ship in the world built on this system, and from this point of view is a noteworthy ship.

A casual glance at the Table of Annual Records opposite well shows the important bearing this Isherwood System has upon the Shipbuilding industry.

The outstanding feature of interest in connection with recent construction is the progress made by the Bracketless System, and it is nothing short of remarkable that in just over 6 months after the completion of the first vessel twelve contracts have been placed, making a total of 14 ships aggregating about 180,000 tons deadweight carrying capacity. This adoption of the Bracketless System with its close alliance to the ordinary Isherwood System shows that the unique advantages offered to shipowners and shipbuilders alike, through the elimination of bulkhead brackets in tanker construction, cannot fail to do much to revolutionize construction for this particular type of vessel just as the Isherwood System has done prior to the advent of the Bracketless System.

The first vessel built on The Bracketless System—the BRITISH INVENTOR — which was purchased by The British Tanker Company, Ltd., and put into service in July last has proved a complete success, and although this vessel encountered rough passages during two round voyages, upon examination in drydock no strain whatever was discernible and the result of the inspection was highly satisfactory in every respect to many experts present.

## Growth of Isherwood Tonnage

| YEAR | SHIPS | DW. CAPACITY TONS |
|---|---|---|
| 1907-08 | 6 | 31,608 |
| 1909 | 36 | 212,992 |
| 1910 | 76 | 484,752 |
| 1911 | 140 | 958,795 |
| 1912 | 240 | 1,777,348 |
| 1913 | 270 | 1,993,034 |
| 1914 | 311 | 2,351,322 |
| 1915 | 468 | 3,548,221 |
| 1916 | 620 | 4,666,000 |
| 1917 | 800 | 6,332,150 |
| 1918 | 1,050 | 8,707,700 |
| 1919 | 1,260 | 10,594,700 |
| 1920 | 1,395 | 11,962,400 |
| 1921 | 1,418 | 12,032,400 |
| 1922 | 1,431 | 12,101,890 |
| 1923 | 1,443 | 12,174,490 |
| 1924 | 1,472 | 12,408,700 |
| 1925 | 1,502 | 12,649,730 |
| 1926 | 1,551 | 13,096,480 |

Contracts now being carried out with ships building on the new system include a second tanker building by arrangement between Sir Joseph W. Isherwood, Bt., and Palmers Sb. Co., four large vessels by Scandinavian shipbuilders, two by French shipbuilders for the Compagnie Auxiliaire de Navigation of Paris, one 21,000 ton Tanker for the Standard Oil Company of New Jersey, and three to be built in British Yards, two of the latter being for Imperial Oil Limited of Toronto.

Apart from the general enthusiasm displayed in the Bracketless System for oil tankers, old clients of the Isherwood System have maintained their confidence by placing further repeat orders, among which are three important vessels with twin screw machinery for transporting oil from Maracaibo to the Caribbean Sea to be discharged into ocean going ships. These vessels, which are building by Palmers Co., Ltd., are of special design embodying the maximum strength with the minimum amount of weight in view of the light draft.

Other vessels include a 13,000 ton tanker building by the Sun Sb. Co., Chester, Pa., to be powered by 3000 hp. Sun-Doxford Diesels, a passenger and cargo vessel for the Southern Pacific Company and two specially designed Diesel driven general cargo vessels to be built for James Chambers & Company of Liverpool on the "Isherwood" Combination System.

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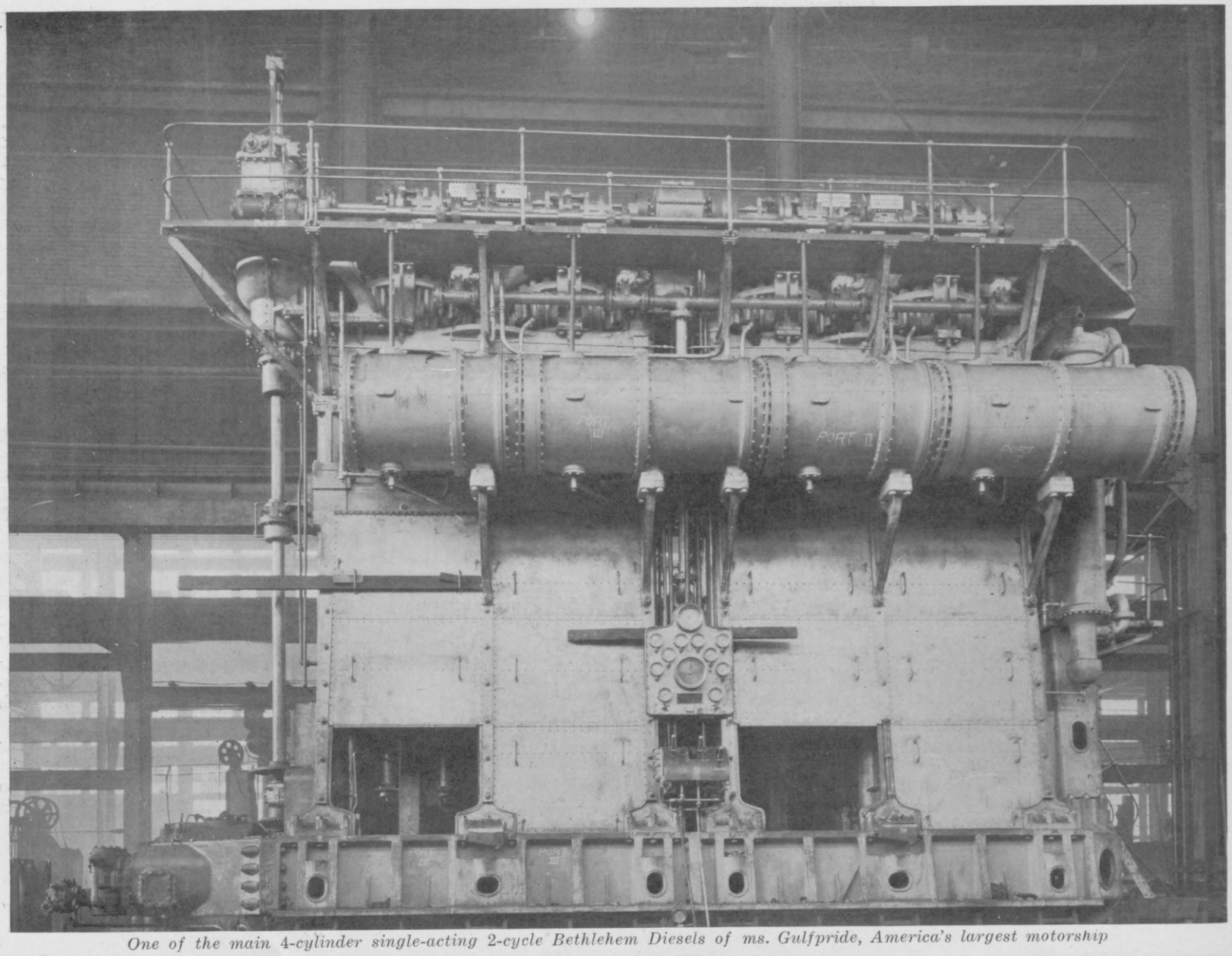
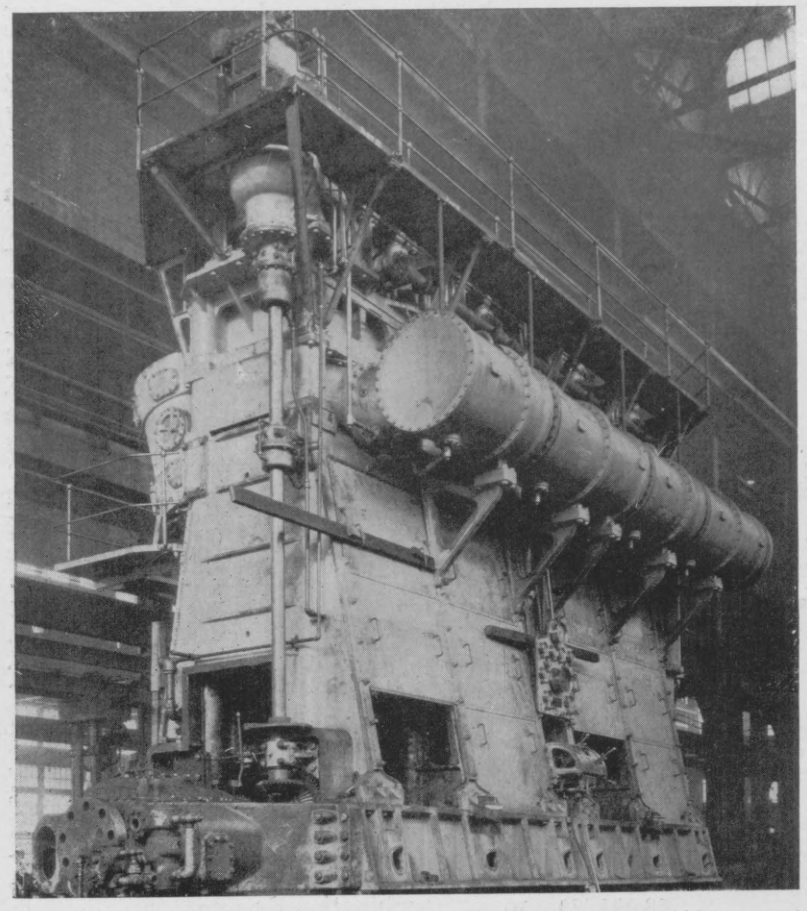
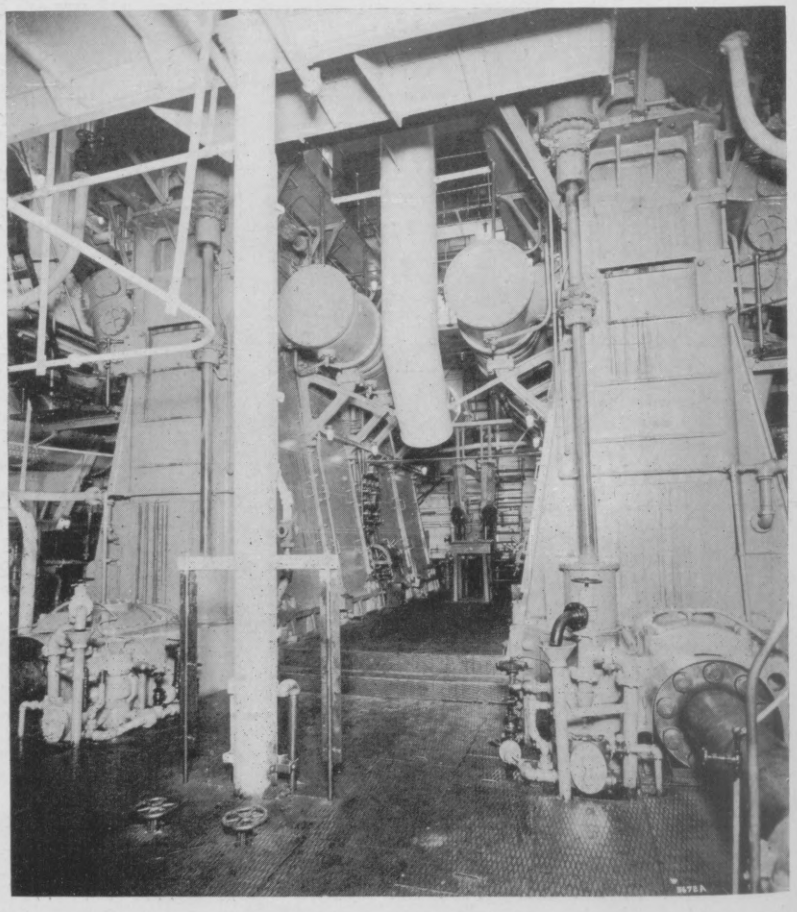


*One of the main 4-cylinder single-acting 2-cycle Bethlehem Diesels of ms. Gulfpride, America's largest motorship*



*One of ms. Gulfpride's main engines in the erecting shops*



*Looking between Gulfpride's engines. Note the absence of flywheels*

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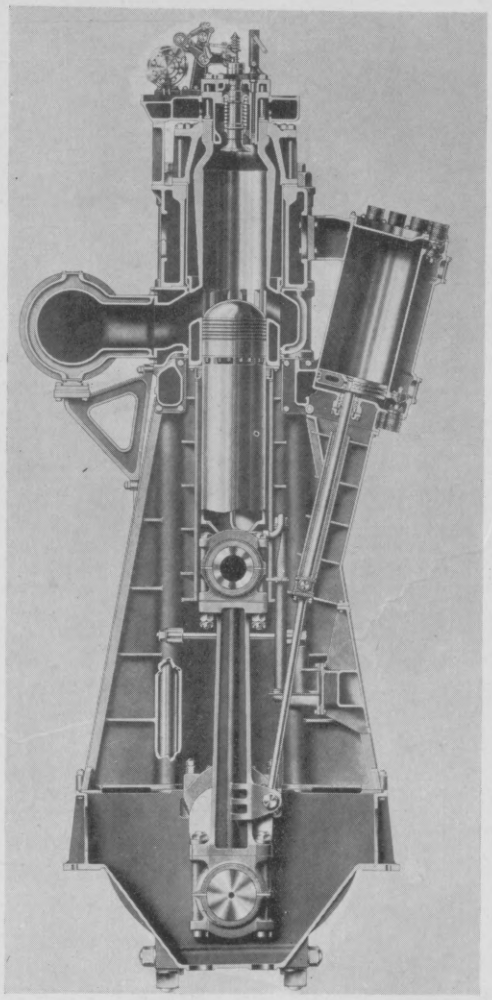
# Machinery of Big Tanker Gulfpride

## Bethlehem Diesels Give Neat Machinery Space—Electricity Used for All Auxiliary Purposes on Ship Except Heating

MS. GULFPRIDE is powered by two Bethlehem single-acting 2-cycle Diesels, built by the Bethlehem Steel Co., and the engine space is remarkable for its roominess. In other words, the main engines with their overall length of 33 ft. 3½ in. are very compact units. Each engine is a 4-cylinder unit rated to deliver 2000 s.h.p., at 115 r.p.m. with 920 ft. per min. piston speed and a mean brake pressure of 67½ lb. per sq. in. Each engine drives its own injection air compressor (from a forward extension of the crankshaft) scavenge air pumps, salt water circulating, lubricating oil, sanitary pumps and fuel oil booster pumps.

The main engine exhausts are so arranged that they can be passed into vertical fire tube boilers, situated at the forward end of the engineroom up in the casing, fitted with special Peabody burners. These boilers which have each 1200 sq. ft. heating surface supply steam for heating the ship and also for driving a certain number of auxiliaries. Notice that actually steam is required to a less extent on Ms. GULFPRIDE, which has been designed primarily to carry gasoline, than on tanks intended for the carriage of fuel oil or of crude petroleum, but even so electricity has been used to a gratifying extent on the ship. The cargo pumps themselves, situated in the pumproom forward of midships are driven by specially designed and constructed motors, the pumps themselves having a capacity of 1500 gal. per min. each at 90 lb. working pressure.

Current for operation of all the electrical apparatus on the ship is provided by three 100 kw. Diesel-generator sets, the Diesel being 3-cylinder 150 b.hp. Nlseco units developing their power at 260 r.p.m., while the generators are 240 volt d.c. Westinghouse units. Two of the generator sets are actually generator-compressor sets since they have connected to them through Cutler-Hammer magnetic clutches vertical 3-stage compressors rated at 150 cu. ft. of free air per min. each.



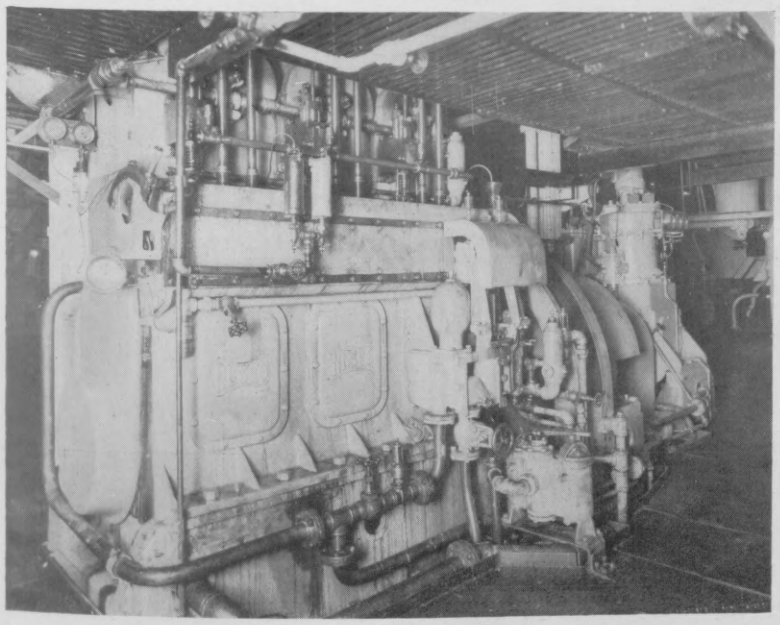
*Section thro' Gulfpride's engines*

The general design of the main engine is based upon the unit system, each unit consisting of bed-plate section, crank shaft section, A-frames, cylinder support, two power cylinders and the necessary valve gear. As each unit comprises two cylinders, by combining two or more units, four, six or eight cylinder motors can be built. To facilitate adjustment the connecting-rod bearings are fitted with Laminated shims. Cylinder oiling is by Bowser force-feed lubricators.

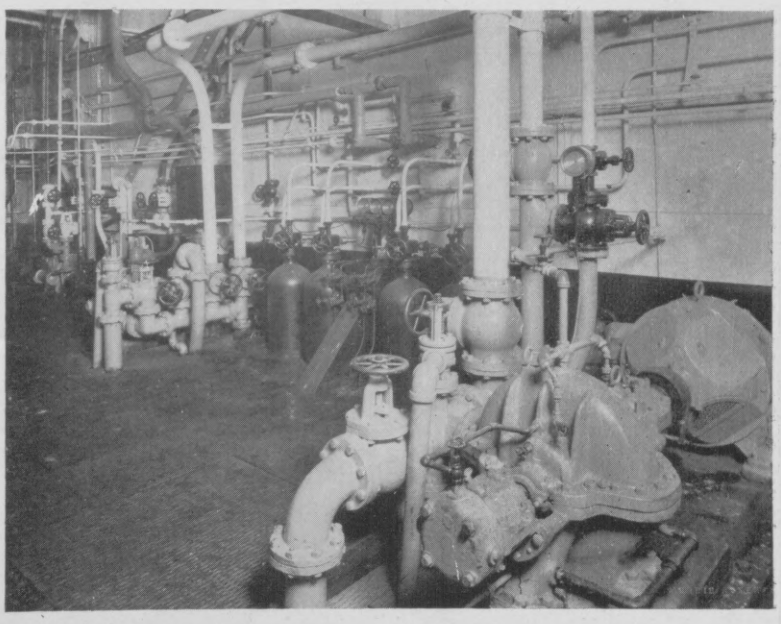
An important feature of construction is the design whereby the major load-bearing parts, such as the cylinder supports, A-frames and bed-plates, are subjected to compression loads only, instead of both tension and compression loads.

The power cylinders are mounted in pairs, each pair being carried by a cylinder support casting. The cylinder support casting is mounted on the A-frames, which in turn are mounted on the bed plate. Six long bolts extend through the cylinder support casting, the A-frames, and the bedplates, thereby holding the parts of each unit rigidly together. When the engine is erected, these long bolts are tightened to produce in them an initial tension about 25 per cent greater than the maximum tension arising from the combustion pressure in the cylinder. The bolts are of such a size that this initial tension is not more than 20 per cent of the elastic limit of the material. As the initial tension in the bolts is more than the maximum tension due to combustion pressure, it follows that the bolts do not stretch in the slightest degree while the engine is working, and the A-frames are therefore always in compression. Since the cylinders are held to the bed-plates only by these large bolts passing through the A-frames, the latter are never subjected to tension. This construction gives the utmost rigidity without undue weight, as the cast iron A-frames need be designed only for compression, the large bolts absorbing all the working stresses.

The large bolts pass clear through the



*One of three 100 kw. Diesel-generator sets*



*Group of auxiliary pumps in engineroom*

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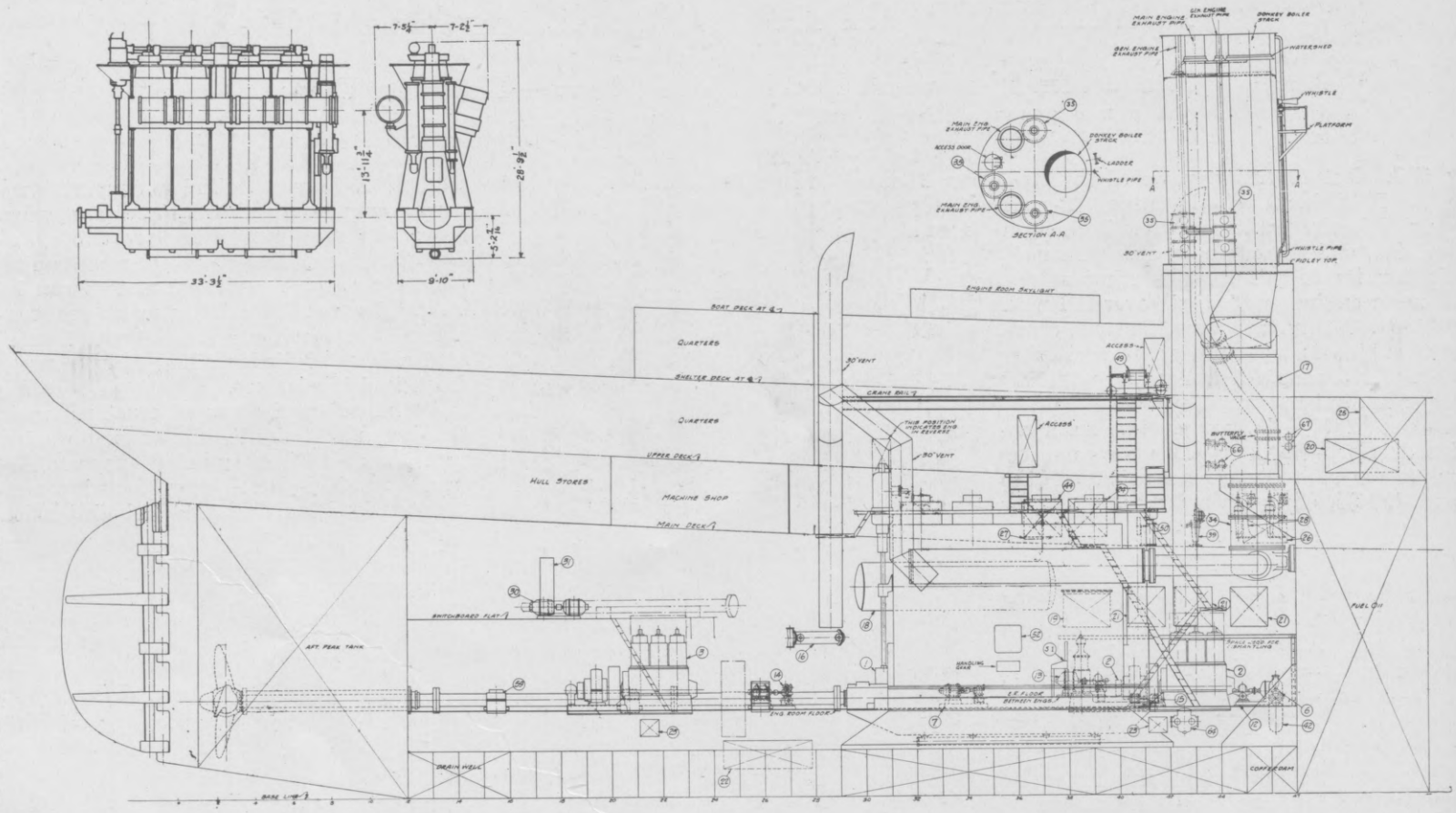
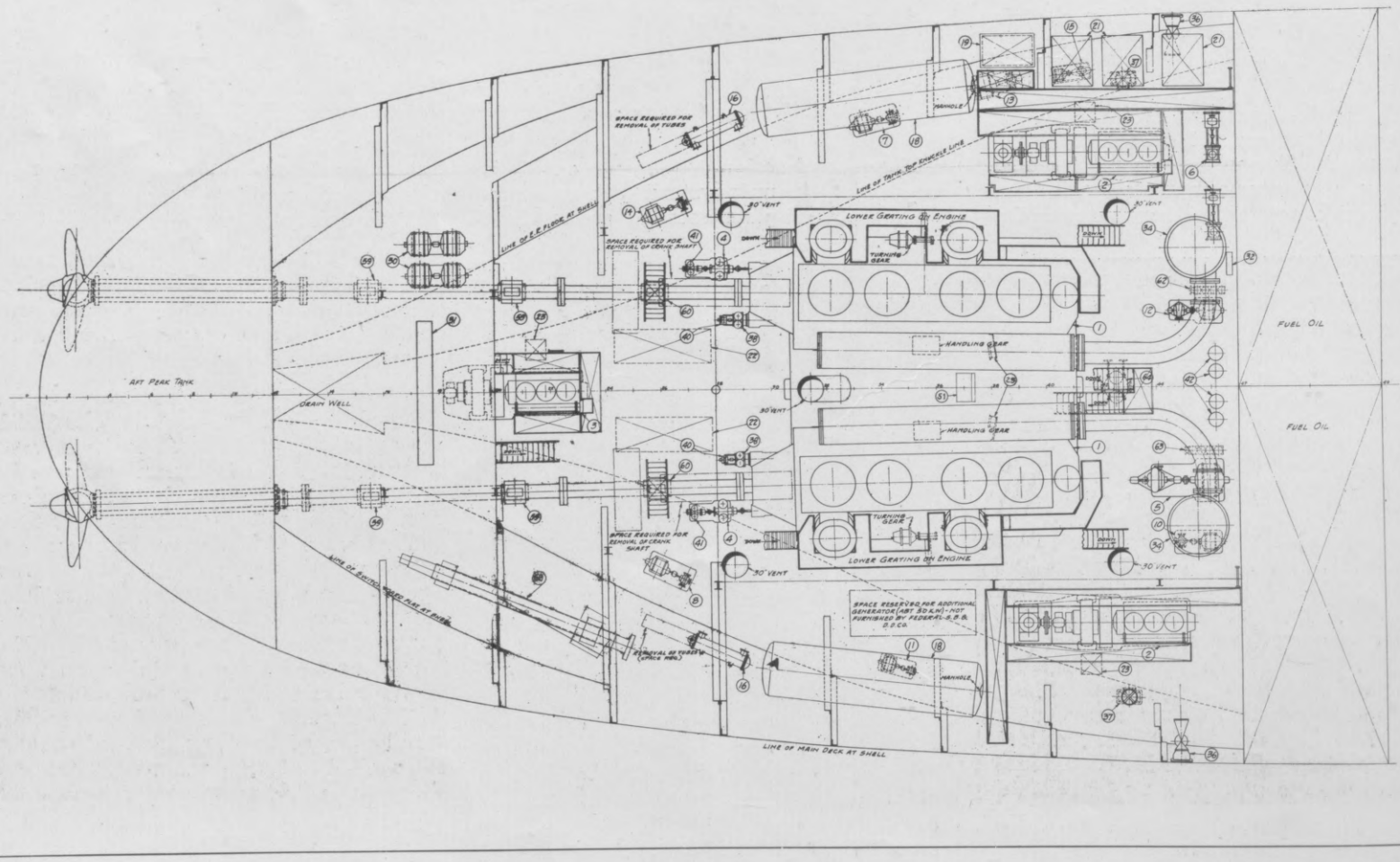



# Machinery Layout of 17,400 Ton Motor Tanker Gulfpride


AFT PEAK TANK
GRAIN WELL
SPACE REQUIRED FOR REMOVAL OF TUBES
SPACE REQUIRED FOR REMOVAL OF CRANK SHAFT
LINE OF E.R. FLOOR AT SHELL
LINE OF TANK TOP SHEER LINE
LOWER GRATING ON ENGINE
TURNING GEAR
HANDLING GEAR
80" VENT
MANHOLE
FUEL OIL
SPACE RESERVED FOR ADDITIONAL GENERATOR (ART 30 A.M.) NOT FURNISHED BY FEDERAL S.B. & D.D. CO.
LINE OF MAIN DECK AT SHELL

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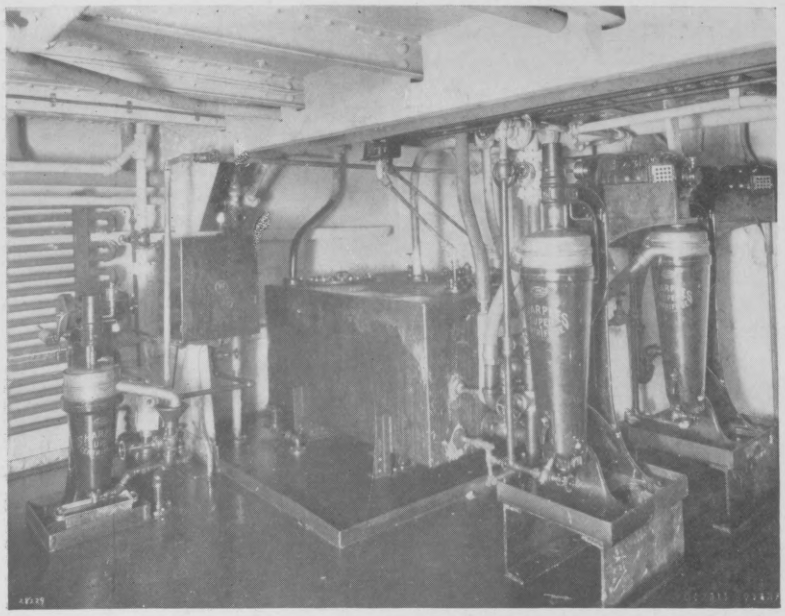
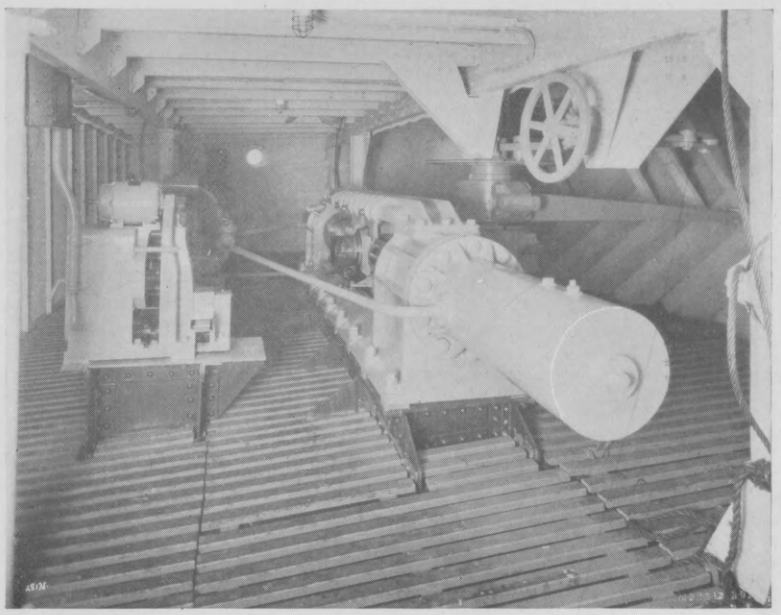


*Sharples centrifuges for fuel and lubricating oil*

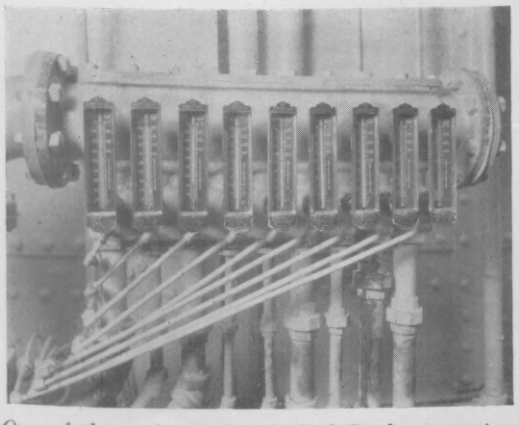


*Hydro-electric steering gear and follow-up control*

bed-plate quite close to the main bearing, the distance from center to center of bolts being less than half the width of the bed-plate. The part of the bed-plate subject to stresses arising from combustion pressures is only the portion between these bolts, and, therefore, the span of bed-plate subject to such stresses is less than one-half, the stresses in the bed-plate are less than one-quarter and the deflection of the bed-plate is less than one-eighth of those of ordinary design.

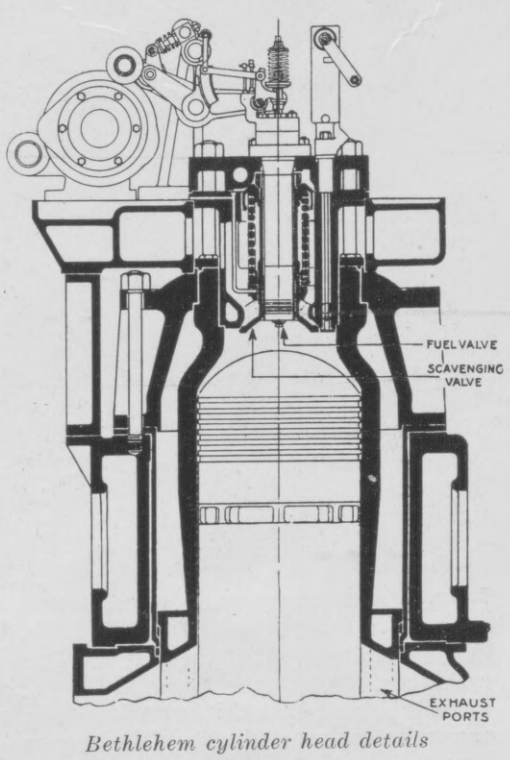
The combustion pressures on the power piston, acting on the bed-plate, set up tension stresses in the lower side of the bed-plate between the large bolts. To resist these tension stresses, the bed-plate is provided in its lower part with horizontal bolts. During erection these bolts are subjected to an initial tension about 25 per cent more than the maximum stress due to the combustion pressure. Therefore, no deflection of the bed-plate can occur and there is no possibility of a cracked bed-plate due to shrinkage strains. No part of either the A-frames or bed-plates is subject to tension due to working stresses, such stresses being entirely taken up by forged steel bolts.

The combination of temperature and pressure stresses inseparable from the operation of Diesel engines under heavy load gives rise to extreme conditions in the power cylinders. Due to the high temperature and the considerable length of the cylinders, the amount of expansion which occurs is relatively quite large.



*One of the main engine A. S. & B. thermometer groups*

The cylinder of the Bethlehem Diesel engine is of symmetrical construction, and it is suspended from its head only, so that expansion and contraction may take place freely in an axial direction. It will be seen that the inner and outer walls of the cylinder are united only at the top and at a point removed from the heat of combustion. By means of the flanges on the outer cylinders, the cylinders are mounted in pairs in the cylinder support casting, designed to receive them. The power cylinder projects downwardly through the cylinder support, to which it is attached only at the flange. The cylinder is thus free to expand axially, with a minimum of stress in its parts. With this construction it is evident that neither the cylinder barrel nor the exhaust ports are subject to axial tensile stresses.




*Bethlehem cylinder head details*

In the Bethlehem engine the scavenging air enters through a central scavenging valve in the extreme upper end of the cylinder, and sweeps downward, filling the power cylinder and driving out the burnt gases, which escape through exhaust ports located around the entire circumference of the lower end of the power cylinder. This positive operation clears the cylinder of all burnt gases.

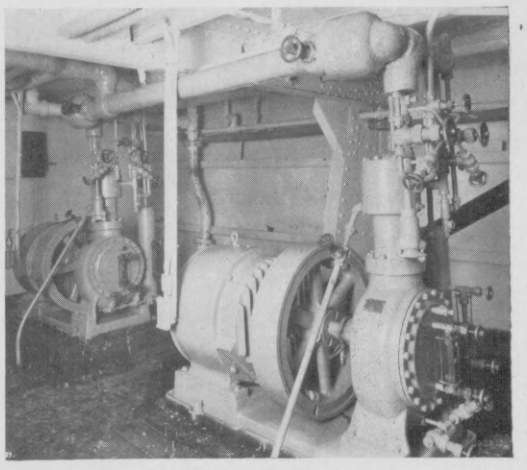
When using low grade fuels, a certain amount of residue is sometimes deposited on top of the pistons. With the scavenging arrangement described such residue is blown out into the exhaust passages before it has time to be hardened by heat.

The scavenging air compressors, one for each pair of cylinders, are arranged on an incline and are driven from the main connecting rods.

Compressed air for injecting oil into the power cylinders is supplied by a 3-stage vertical air compressor securely bolted to the forward end of the engine frame and driven from an overhung crank bolted to the forward end of the crank-shaft.

The injection air compressor on the Bethlehem Diesel engine is of the differential piston type, having a double-acting first stage and single-acting second and third stages. The valves are of the automatic disc type, which are of efficient and durable construction with ample areas, readily accessible and easily removed. The air is cooled after each of the three stages of compression.

Northern pumps for circulating water, lubricating oil, fuel oil supply, bilge and sanitary service are fitted. A pump group bolted to the engine has been arranged with special reference to ease of inspection and



*Brunswick-Kroeschell refrigerator set and Diesel motors*

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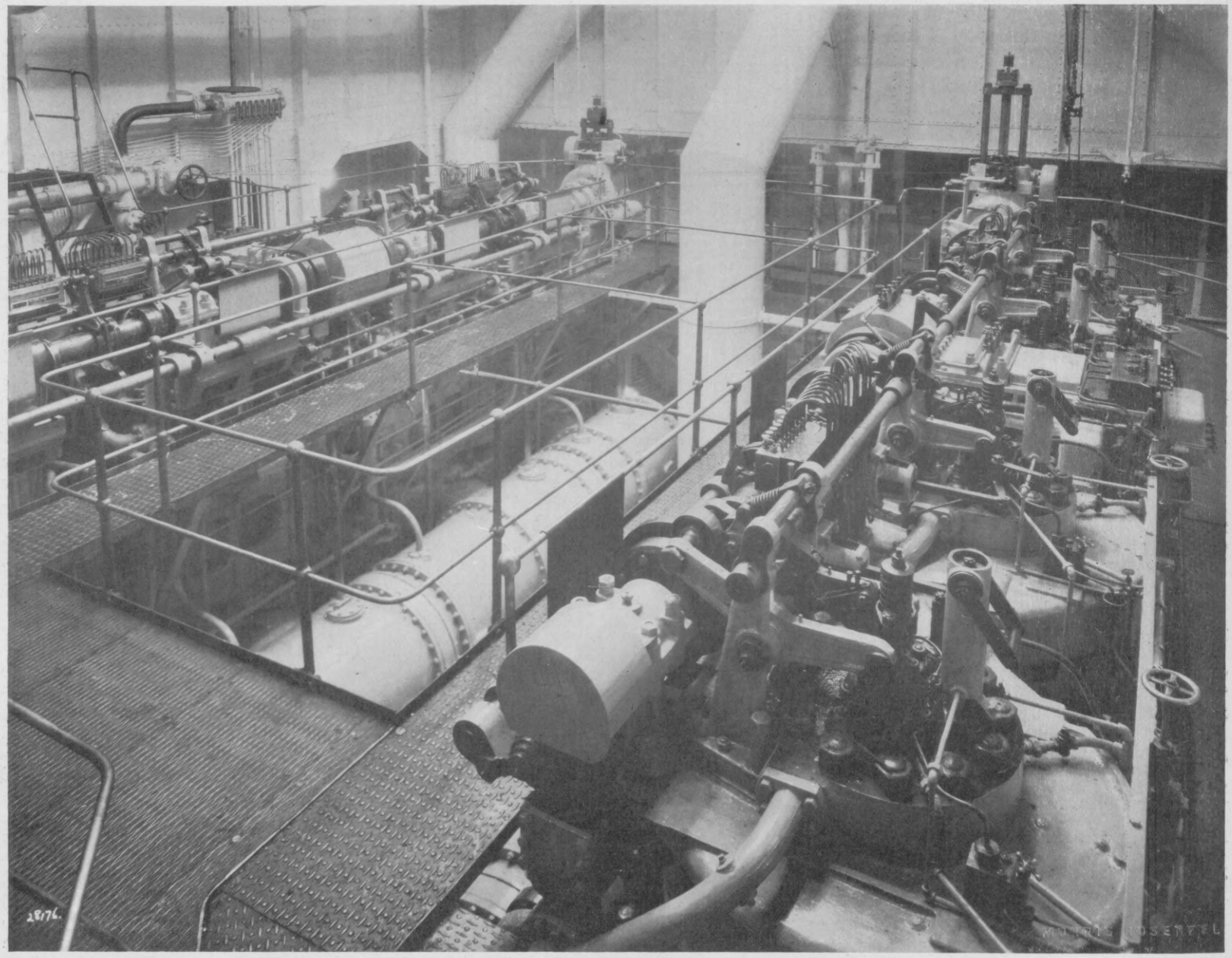
maintenance. The pumps are driven by a train of gears from the main crank-shaft.

A single-collar thrust bearing is furnished with the Bethlehem engine, this being carried in a heavy cast iron housing which is bolted to the after end of the bed-plate. The thrust of the propeller is thus taken up and well distributed to the ship framing by the engine bed-plate.

A three lever control is used. The left hand lever controls the master valve which supplies starting air to the engine. Properly timed valves admit this air into the engine. By moving the lever into the astern slot, compressed air is admitted to the cam shaft reversing mechanism, which sets all cams in the proper position for the reversal of the engine. Advancing the lever further into the astern slot sets the throttle for the required amount of fuel. At the same time the engine may be started with compressed air by moving the extreme left hand lever upward. As soon as fuel in the cylinders is ignited, the starting air lever is returned to its original position, shutting off the starting air, leaving the engine engine air compressor on the main engine.

On Ms. GULFPRIDE the auxiliaries are all electrically operated and for the deck auxiliaries, steering gear, and all applications where magnetic type control is employed, the motors were furnished by the Westinghouse Company and the control apparatus and brakes by the Cutler-Hammer Mfg. Company. Such auxiliaries as are located above deck comprising the windlass, cargo winches, warping winches and mooring winch, are all of the totally enclosed watertight type.



*General view looking along cylinder tops of ms. Gulfpride's main engines gives an impressive idea of the spaciousness of machinery space*

individual cylinders, causing the engine to start. Fuel is then injected into the cylinders and when combustion takes place, the starting air is automatically cut off by check valves in the cylinders, and the master valve may be closed. Rapid and positive starting is obtained with this system, by which fuel oil and starting air may be used on all cylinders at the same time.

The middle lever controls the amount of fuel injected into the cylinders and works in a double slot somewhat similar to the selective gear lever on an automobile. The amount of fuel is increased by pushing the lever away from the operator. When the operator wishes to reverse the engine he pulls the fuel lever towards him as far as he can, shutting off fuel and stopping the tirely controlled by the single middle lever, or throttle.

It will be seen that this reversing gear is practically foolproof for the following reasons: the engine cannot be reversed without first entirely shutting off the fuel; the engine cannot be given fuel in the reverse direction until the reverse gear has completely moved into the proper position.

The right hand lever determines the lift of the fuel valve so as to properly control the injection air at all speeds and powers, as previously explained. This arrangement has the additional advantage of allowing the engine to be started, in emergency, without the necessity of charging the injection air bottles beforehand, as injection air may be built up very rapidly by the en-

The anchor windlass controller equipment is rated at 75 hp., and consists of the full magnetic type control comprising a watertight pedestal-mounted reversible drum type master with radial drive, a non-watertight enclosed magnetic contactor panel, a set of open type zinc plated grid resistors and an 18 in. type M pedestal mounted watertight shoe brake.

The watertight master drum controller is located above deck, as is also the 18 in. type M watertight brake. The magnetic contactor panel and resistor are located below in the windlass room. The master controller provides for five points of speed control, hoisting and lowering, the connections being such as to provide for dynamic lowering and dynamic braking in the "off"

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position. The magnetic contactor panel carries two line contactors for hoisting, and two for lowering, each pair mechanically interlocked against the other. Acceleration is handled by four accelerating switches, each controlled by a series relay. A load relay is provided which is set to operate on about double full load and which will cause enough resistance to be inserted in the armature circuit to reduce the current to about 1¼ full load regardless of

*James Kennedy, Gulf Refining Co.*

the position of the master. When the load becomes reduced to approximately full load, the series relays will permit the accelerating switches automatically to cut out the armature resistance up to the position in which the master drum was left, providing the load does not exceed the setting of the series relays. The panel also carries a magnetic switch for opening and closing the brake circuit in response to the master and a spring closed magnetic switch which is held open on all running positions of the master but which automatically closes when the master is brought to the "off" position and places one section of resistance in parallel with the armature for dynamic braking. This assists the magnetic brake in providing quick stopping of the motor.

The cargo winch control equipment consists of a watertight reversible drum controller with straight line lever drive, a watertight overload and low protecting panel, and a watertight rheostat box containing the necessary grid resistors which are of the zinc plated type.

The brake employed is of the magnetic shoe type 14 in. size, of watertight construction. This control equipment provides for seven speeds of control in either direction of operation with dynamic lowering in the "lowering" and "off" positions. A feature of the control is that an electrical interlock is provided between the watertight resistor box containing the resistors and the drum controller so that the equipment is only operative at such times as the ventilating covers of the watertight resistor box are opened, this being accomplished manually, the opening of the lower and upper covers being effected simultaneously. There are two of these cargo winch equipments, each rated 27 hp.

The warping winch control equipment consists of a watertight reversible drum controller providing seven speeds of control in either direction of operation, a watertight overload and low voltage protecting panel, a watertight rheostat box containing the necessary zinc plated grid resistors. A 10 in. electrical interlock and a type MW. 1 in. shoe brake are provided similarly as for the cargo winches, insuring operation of the equipment only when the covers of the rheostat box are open. The equipment is rated 15 hp.

The mooring winch controls are rated 20 hp. Two of these equipments are installed and each equipment consists of a watertight reversible drum controller seven speeds in either direction of operation, a watertight jam relay and low voltage protecting panel and one watertight rheostat box containing the necessary resistors for both mooring winches, with electrical interlocks provided so that the covers of the rheostats boxes must be open before either or both of the mooring winch controls can be operated. A 14 in. watertight type M pedestal mounted shoe brake is provided for insuring holding of the load and quick stopping of the motor.

There are four cargo pump controllers, two of 100 hp. each, and two of 40 hp. each. Each of these controllers is of the non-reverse magnetic lockout type providing for speed regulation by shunt field control and each controller is mounted in a sheet steel non-watertight enclosing case. The armature and field resistors are self contained within the enclosing case. Operation is by means of watertight push button control stations conveniently located below the panels.

Since the cargo pump motors are separately ventilated and since it is desired to at all times insure that the motor frames be free from explosive gases, a blower and exhauster are provided for separate ventilation of the motors. The electrical connections are such that it is impossible to operate the main cargo pump motors until the blower equipment has scavenged the air from the motor frames. This electrical interlocking feature therefore removes the possibility of danger from operating the motors when an explosive mixture might be present.

The fire and bilge pump controller which is also of the magnetic contactor type variable speed is rated 60 hp., 230 volts. Control is effected by means of two push button control stations, one local, the other remote. Since the equipment is located in the engine room space a drip-proof, non-watertight, sheet steel enclosing cabinet is provided for the panel.

The steering gear which is of the hydro-electric type utilizes a time limit acceleration type of control which is rated 20 hp., 230 volts. The equipment mounted on the panel also includes an adjustable overload relay and provides low voltage protection. The apparatus is mounted in a sheet steel, non-watertight, drip-proof case. Control is by means of a watertight push button, separately mounted.

On all of the deck auxiliaries where Cutler-Hammer magnetic brakes are used, they have the following operating characteristics. They are spring applied, magnet released. The magnet is of the direct acting type, the motion being in direct line with the wheel. When the magnet coil is

*Arthur West, designer of Bethlehem engine*

de-energized the spring which is in the center of the magnet forces the two magnet members apart and applies uniform pressures to both self-aligning brake shoes. The motion of the magnet is short so that there is no hammer blow or bouncing when the brake sets. All of the brakes employed on this installation are of the improved type and to insure non-rusting under service conditions bronze fittings are used.

In GULFPRIDE'S electrical equipment over 16,000 ft. of insulated cable was supplied by the American Steel & Wire Co.

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J. C. Rolphs, Manager, Marine Department, Standard Oil Co. of Cal., is now in Europe, and is said to be negotiating the construction of three 15,000 ton motortankers.

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Two 180 ft. Diesel driven combination passenger and freight river vessels are reported to be under consideration by the Harkins Transportation Co. of Astoria, Oregon.

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The Mechanical Engineering Department of the Towne Scientific School, University of Pennsylvania, announces a fuel engineering course which will open on Sept. 30, 1927. The object of this course is to graduate candidates in the degree of Master of Science in Fuel Engineering.

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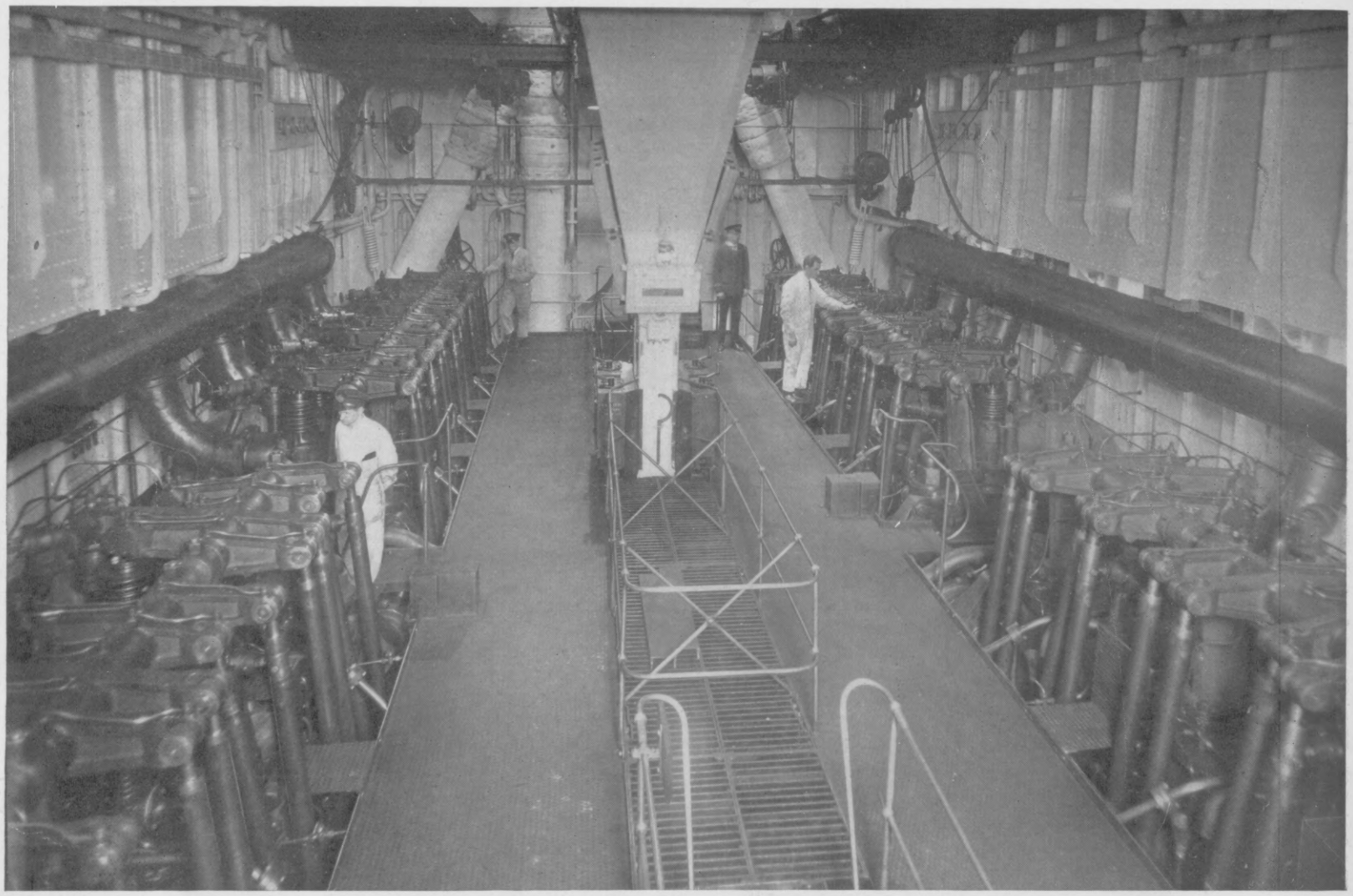
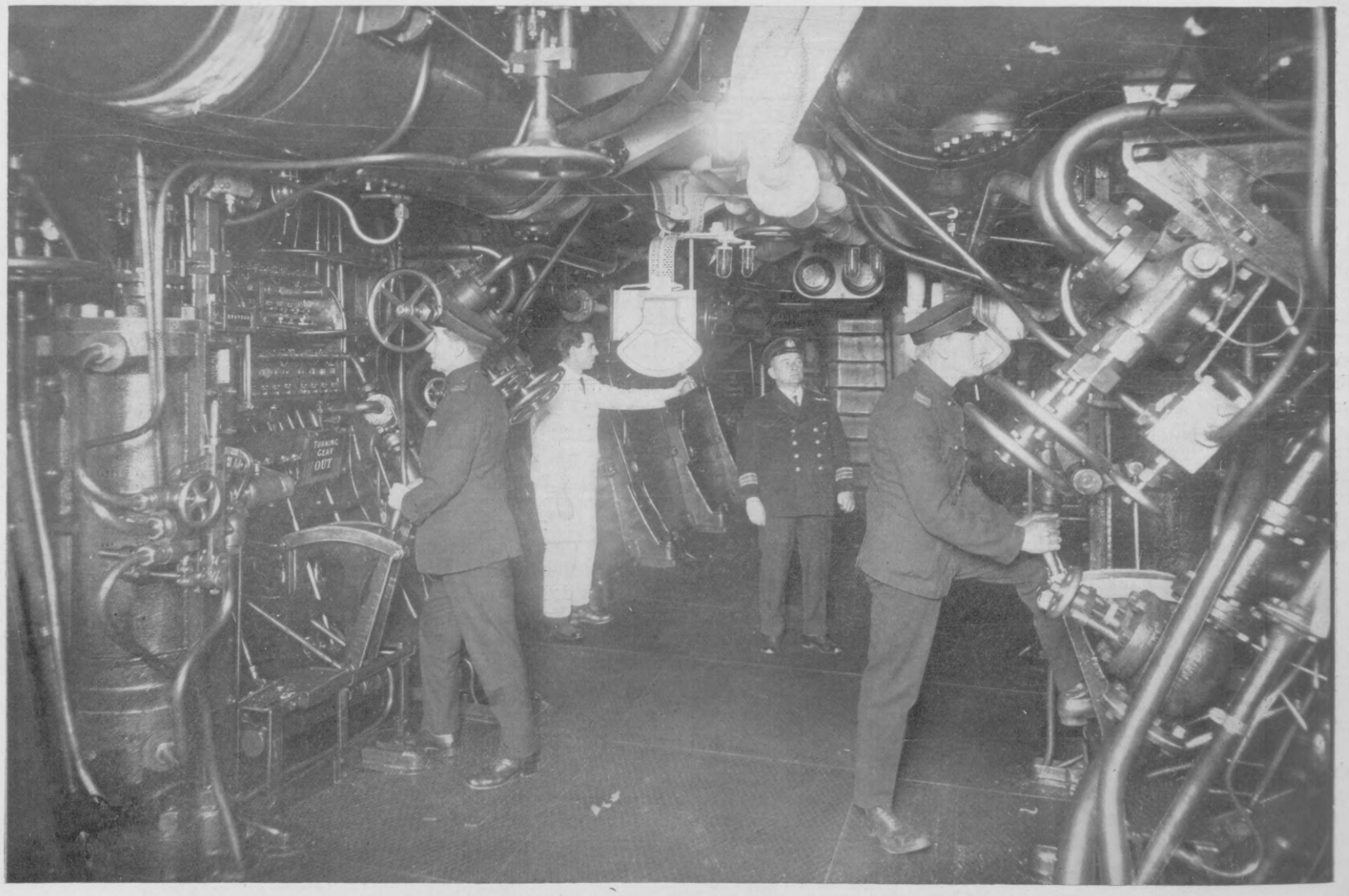


*A total of* 20,000 *i.hp. is registered by these two main engines of the motor passenger liner Asturias and her sister ms. Alcantara*




*Control position for the two main double-acting 4-cycle Diesels of the big motorliner Asturias, which has just completed a Round Africa cruise*

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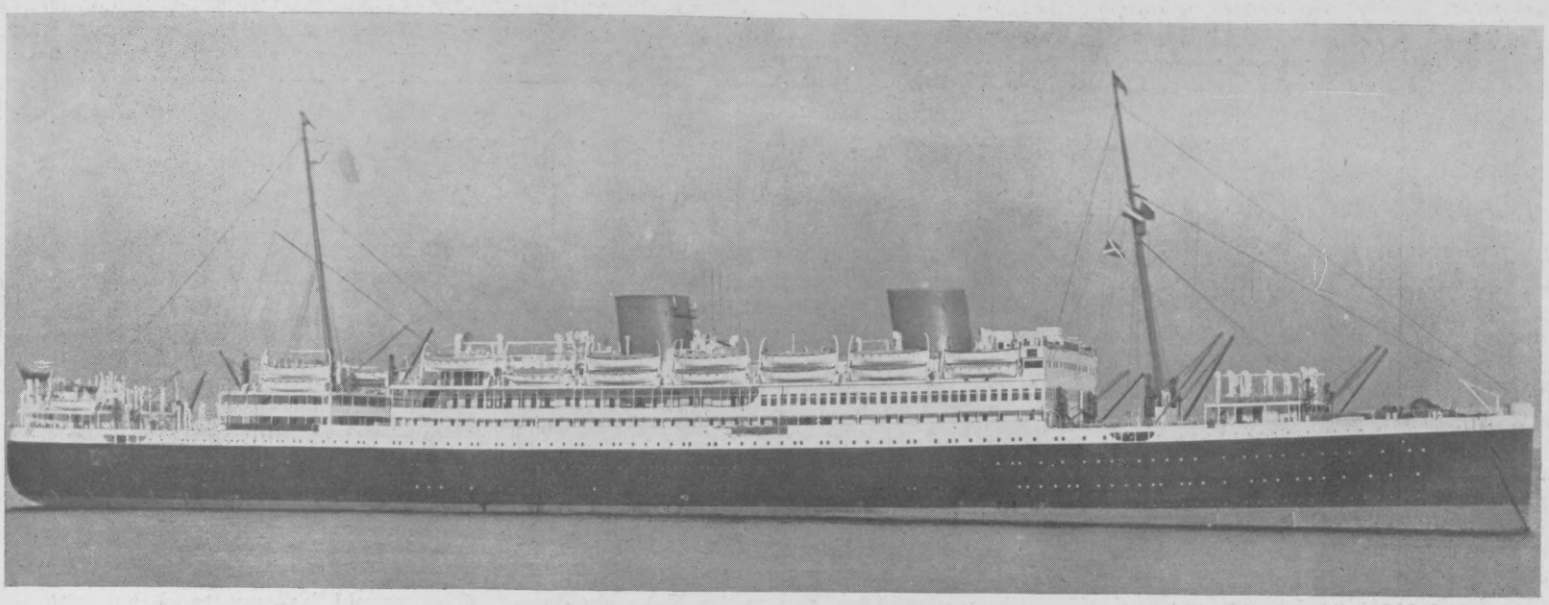


# Ms. Asturias Is Cruise Ship and Pioneer

## Establishes Precedent for Ocean Cruising and Is Pioneer Upon Which White Star Line's New Motorliner May Be Based

RETURN of the 22,500 ton motorliner ASTURIAS from her long 'round Africa cruise on April 25 marks the completion of an important experiment in motorshipping. It has placed upon the motorship the mark—Comfort with Economy. The passenger—100 per cent more critical on ocean cruising than an ordinary passage—demands the former. The shipowner needs the latter. The motorship satisfies both their demands, and when the ASTURIAS with 22,000 long miles to her credit returns to Southampton to resume her scheduled sailings on the Southampton-South America run, her owners will have every reason to feel satisfied with their choice of double-acting Diesels for the propulsion of ASTURIAS, ALCANTARA, CARNARVON CASTLE and ACCRA, the fleet of ships forming the nucleus of the big motorship group owned and controlled by Lord Kylsant, world's largest shipping magnate.

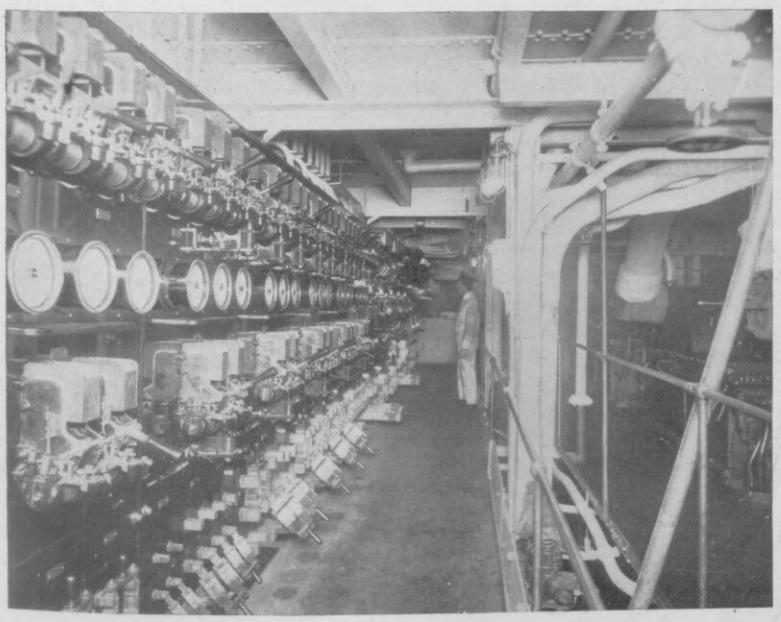
Successful and economical operation of these ships has without question been instrumental in influencing the White Star Line—the latest Kylsant "purchase"—to place a contract with Harland and Wolff, Belfast for a motorliner which, according to a copyright message to *The New York Times* is to be between 25000 and 30000 tons or between the tonnage of the White Star liners HOMERIC and ADRIATIC.

The White Star Company also intends to build a liner of the Olympic type, but the date of laying the keel of this ship has not been fixed.

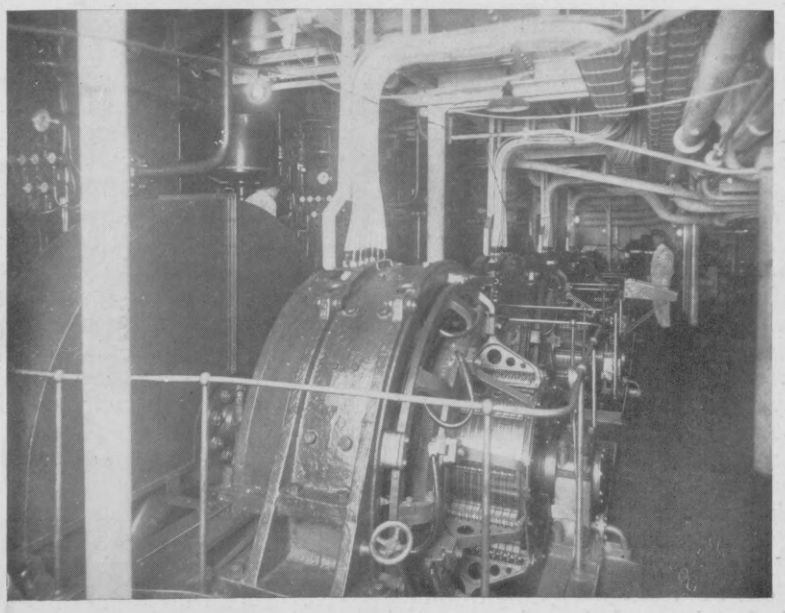
The motorship of ADRIATIC type will be the first of the White Star fleet to be driven by Diesel engines.

The new ship will be propelled by H. & W.—B. & W. Diesels of double-acting 4-cycle type which have proved so successful in the existing Kylsant motorliners. In conjunction with these, big Diesel generator sets will be fitted for supplying current for the whole of the auxiliary machinery. A ship of this type, too, if we may in any way judge by the existing ADRIATIC design, will inevitably have considerable cargo capacity and this in turn means a very complete deck machinery equipment. Ms. ASTURIAS handles her cargo by hydraulic cranes, in conformity with R. M. S. P. practice. It is just a little difficult to understand why this idea has been carried out on a ship which otherwise is so well electrified. The solution, maybe, lies in the fact that the ship is definitely of the fast express type than of the intermediate type.

Some idea of the machinery space layout of the big motorliners of ASTURIAS type is given in the illustrations accompanying this article. Their compactness is striking. Remember, however, that Ms. ASTURIAS and her sisters are pioneers. They are the foundations upon which the motor transatlantic mammoth liner of the future will be based.



*Asturias' main switchboard in generator room*



*A group of main generators in Asturias' type motorliner*

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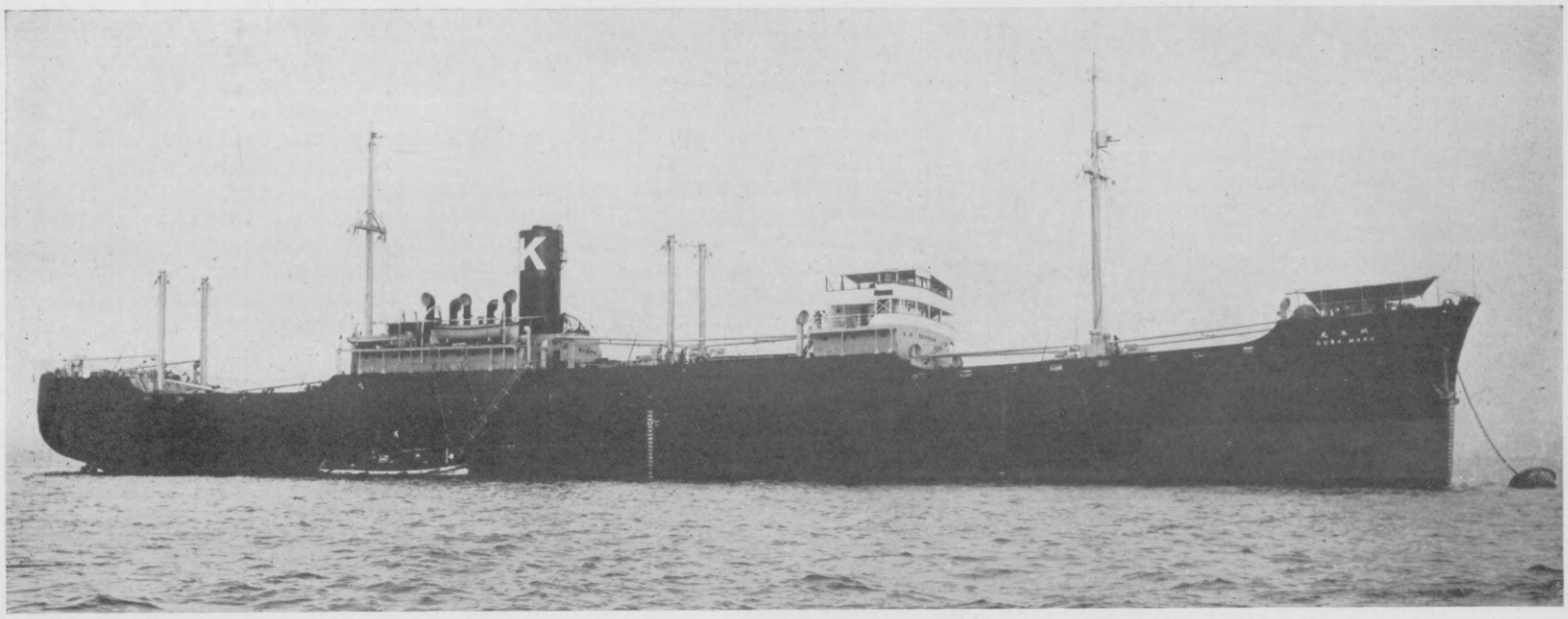
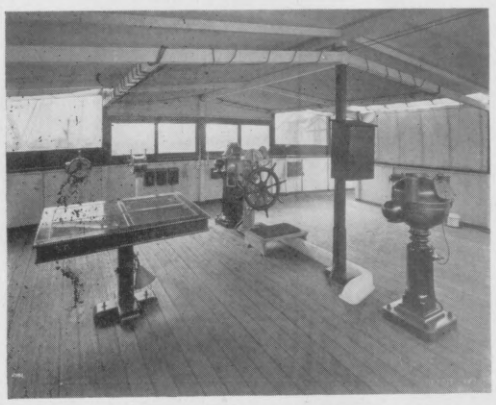
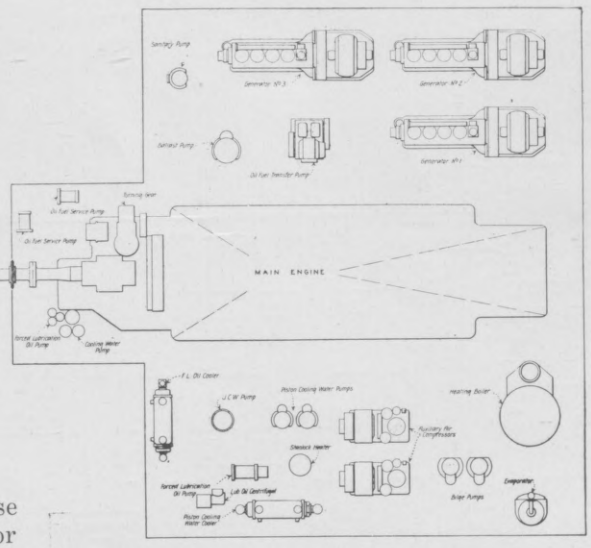


# Big Japanese Opposed Piston Engined Freighter

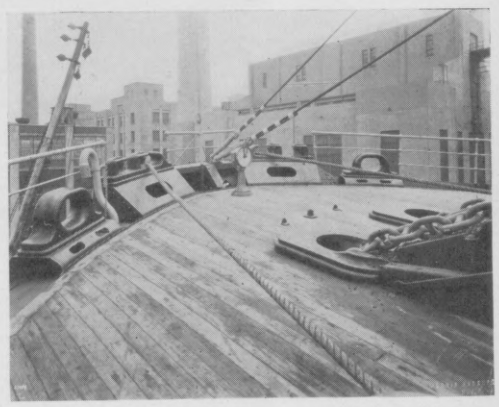
## Ms. Cuba Maru, 9100 Tons Dw., Has British built Fullagar Engines of 2500 hp. and Japanese Built Auxiliary Diesels



*Navigating bridge is open type*



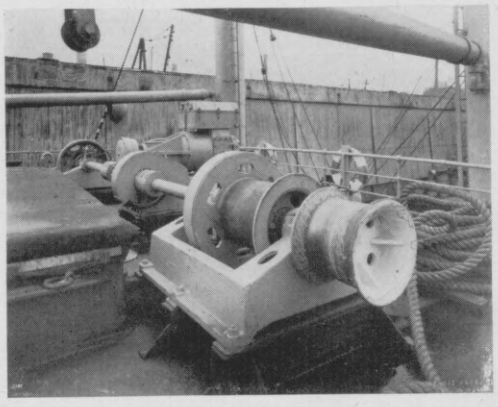

*General arrangement of machinery*



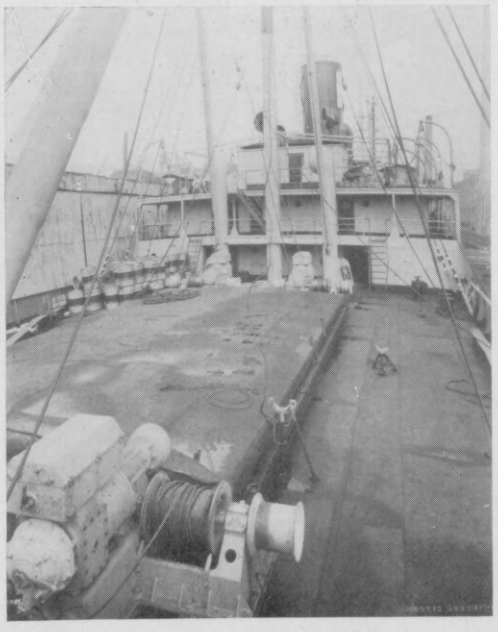
*Forecastle head has rounded outline*

MS. CUBA MARU, a 9100 ton Japanese motor freighter is on schedule for the round the world freight service of the Kawasaki Kisen Kaisha, or "K" line as it is more generally called, from New York. She was completed last year by the Kawasaki Dockyard, Kobe.

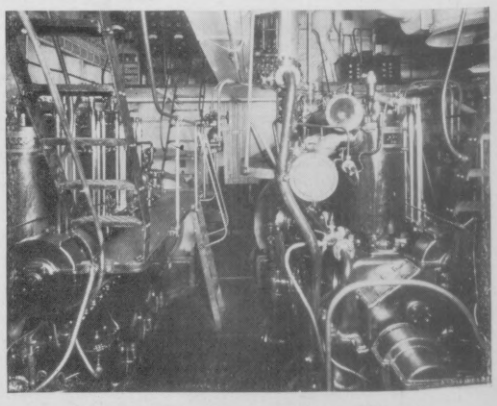
A deadweight capacity of about 9100 tons is given by a length b.p. of 405 ft., a beam molded of 53 ft. and a depth molded to upper deck of 34 ft. The ship is of three island type with a long bridge deck. She has a peculiar partially raked stem. There are in all four cargo holds including one deep tank, as is customary in ships intended for the Far Eastern cargo trade. MS. CUBA MARU has a single screw working in conjunction with a "Star" type contra-propeller which is reported to have considerably increased her efficiency. The main engine is a 6-cylinder Camellaird-Fullagar Diesel built by John Brown & Co., Clydebank, Scotland. The cylinders are 22-in. diameter and have a 33-in. stroke, the normal speed being 98 r.p.m. CUBA MARU'S service speed is driven as 18 knots, and on her trials she did 13.68 knots. "The fuel consumption," the owners state, "is very low, only 10½ tons being consumed per day fully loaded which is equivalent in horse-power to what would be got out of 35 tons of coal, besides the advantage of less bulk and labor."



*Novel cargo and warping winches*



*Looking forward from Poop*



*Japanese-built Auxiliary Diesels*

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# Pulverized Coal an Answer to Diesels?

## Steam's Latest Claims Refuted by Critical Analysis Which Show That Oil Is Not Increasing in Price, Nor Is There Any Shortage

IN their valiant struggle for existence, steam interests are now directing considerable attention to the possibilities of the economies of pulverized coal under the boilers of steamships. There is nothing new in this idea—it was tried out in a Dutch steamer several years ago—but to date it has never been fitted extensively. An esteemed contemporary in an editorial entitled—"Pulverized Coal an Answer to Diesels"—claims that this fuel will go a long way to making existing old-time marine power-plants cheaper in operating and fuel costs than the Diesel engine. That there may be something in this claim we do not dispute, but there are many sound reasons why it can never go far enough to become a serious competitor of the high thermal efficiency oil engine of the present day.

If pulverized coal experiments now being made prove successful in a commercial way, unquestionably the method will be used on many existing coal-burning steam driven ships.

Our contemporary makes, in the same editorial, the somewhat sweeping statement that oil is increasing in price. Facts and market records do not support such a claim. In fact, not only has oil been steadily dropping in price for several months due to overproduction, but its cost is now half what it was when motorship construction commenced its rapid rise 6 to 7 years ago. Today several of the leading oil companies are working on quantity production of special Diesel fuel-oil which will be marketed at a price which will give quite a substantial advantage over coal. That no oil shortage is in sight in this decade has been stated in signed articles in MOTORSHIP by officials of the Standard Oil and Royal Dutch-Shell companies, which are two of the greatest oil producers and marketers in the world.

The reason why pulverized coal firing of boilers is never likely to be a serious competitor to the oil engine can very easily be explained. Modern motorships have developed—apart from fuel economy—so many all-round advantages such as cleanliness, better operating conditions, better speed, simplicity and speed of fueling, etc., and experience shows that the shipowner having once realized their benefits first hand does not turn back to steam, unless he or his advisers made an engineering blunder in the selection or arrangement of the machinery of his first motorship and they feel that they have burned their fingers.

The shipper's cry today is for speed, which shipowners—particularly foreign owners—are answering by building fine modern cargo motorships of 14½ knots speed. Such speed places coal-burning vessels entirely out of the running in today's competition. A pulverized coal burner of 14½ knots sea speed on a load displacement of 16,000 tons has a daily fuel consumption at sea of 100 tons and at least 10 tons per day in port, whereas a motorship of the same displacement and speed only burns about 22 tons at sea and ½ ton in port. For a 20 day voyage with 10 days in port the coal burner would have to bunker 2,100 tons of fuel and about 300 tons of boiler water without allowing a margin for delays through bad weather. On the other hand about 550 tons of oil and 20 tons of cooling water, if fresh water is used for cooling, would carry the Diesel ship the same distance and leave her with five days' supply of fuel. Allowing the motorship to bunker another 550 tons at the start of the outward voyage, making 1120 tons altogether for a round voyage, she still is able to carry well over 1,000 tons more dividend-earning cargo than the pulverized-coal burning freighter, aside from the greatly reduced port fuel charges.

Taking coal at an average of $4.35 per ton delivered aboard ship at Eastern U. S. ports ready for pulverizing, and taking the cost of pulverizing and mechanically stoking the same on the ship as another 20 cents a ton, the 20 day voyage and one 10-day port stop of the 14½ knot steamer would cost $9,550. With Diesel oil at $14 per ton (by using centrifuges cheaper oil can successfully be burned) the motorship's fuel bill for the same sea and port periods will be $6,524 (460 tons). This means a saving of $3,026 for the 30-day operating period, aside from the greater earning power of the extra 1,000 tons of cargo carried on the same displacement.

The cost of coal for the steamer's return voyage would vary with the route of the ship, whereas the motorship carries fuel for the round trip at a fixed price.

# The Motorship Engineer's Wage

SHOULD motorship engineers be paid more than steam engineers, and furthermore should such an increase be compulsory regardless of proficiency or solely by reason of meritorious performance?

A partial answer to these questions has been given in the recent announcement that the Shipping Board has granted the request of marine engineers for an increase of $25 a month to chief engineers employed on the converted motorships. An increase of $10 is also granted to firsts and seconds, while the pay of thirds is advanced $5. It was also announced that the pay of the captains on the motorships will be increased $10 per month.

MOTORSHIP has always advocated higher remuneration for the engine-room crews of motorvessels in order to encourage the best grade of engineers to go to sea and to increase the operating efficiency of Diesel engines.

Men who conscientiously study the new problems that have arisen in their calling, who undergo special training, and who work harder and longer than their regular watches call for, consequently improving the running of the ship's machinery and reducing repair bills, are entitled to some extra compensation. Bright, progressive marine engineers who forge ahead and keep pace with modern maritime developments, instead of being content to remain at the steam throttle to the day of their retirement ashore, should receive proper recognition from shipowners.

But to request as a body a differential of $25 per month for chief and $10 for first and second on motorships over the amounts accepted as the wage scale for steam engineers simply because men have passed their motorship engineers license examination, and regardless whether they are good, bad or indifferent, is a different proposition. While the Shipping Board has granted this request, the private shipowner is likely to oppose any such wholesale addition to his pay roll.

Also we must remember that it gives the Diesel opponent another opportunity to put forward a plaint for the higher cost of operating motorships and so to block additional construction and conversions. This in itself means fewer ships paying the higher wage.

Would not the marine engineers' association which urged this arbitrary wage increase make for far better progress and all round benefits, both to its members and to shipowners, if it strongly advocated some form of substantial increase or bonus based on performance of the Diesel engines in their care? This extra remuneration could profitably be considerably higher than that now asked by the association, but in such a form that it could be adopted as standard by private owners and perhaps by the Shipping Board. It should not be difficult for an arrangement to be drawn up and agreed upon which would be satisfactory to engineers and ultimately be very beneficial to owners. Such a plan, being basically right, stands on a more solid foundation.

---

Hamburg-American Line is to build two 17,000-ton motor passenger ships, six 10,000-ton motor freighters and six 5,500-ton steam freighters. The completion of this tonnage, together with the 160,000 tons now under construction, will give the Hapag a fleet of modern ships of over 1,000,000 gross tons.

The new passenger ships are to be of CLEVELAND type with accommodations for cabin and third-class passengers. They will have a speed of 17 knots and will be among the largest and finest motorliners in the world.

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# Southern Pacific's Big Diesel Ferry Fresno

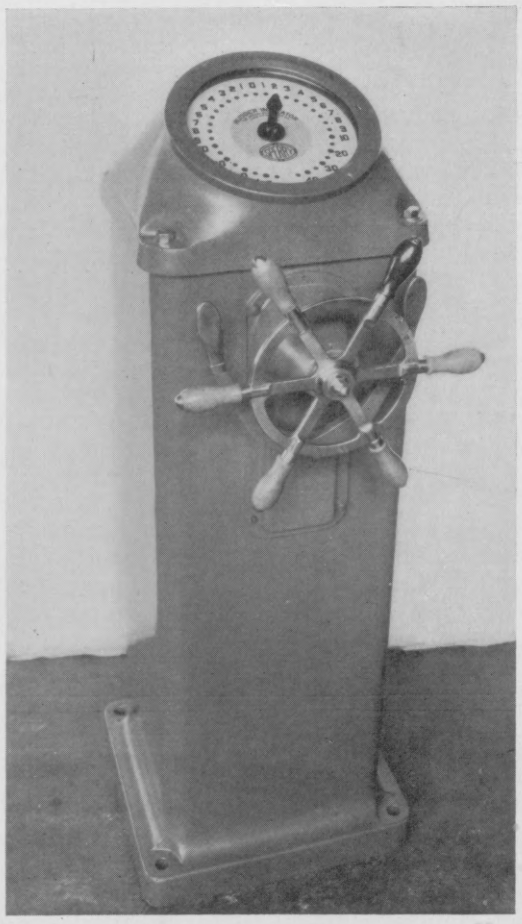
## First Unit of Modern Ferryboat Fleet for San Francisco Bay Service Expected to Save $80 per 16 hr. Day per Boat Over Steam

THE first Diesel-electric Southern Pacific automobile ferry, FRESNO, has just been completed. This vessel is the first of three, all of which are to be operated by the Southern Pacific Company between Oakland and San Francisco. The other two ferries will soon be finished by the Bethlehem Shipbuilding Corporation at the Potrero plant in San Francisco. Three other ferries of exactly the same design are being constructed by the Northwestern Pacific Railway Company. One of these is fast nearing completion at the plant of the General Engineering & Drydock Company at Alameda, California. The two other hulls have been launched from the ways of the Moore Drydock Company of Oakland, California. All six ferries have been designed and built under the supervision of the Motive Power Department of the Southern Pacific Co.

Such strong preference for Diesel Electric drive is exhibited in the number of new ferries being constructed around San Francisco Bay that soon the routes of Bay travel will be swarming with modern passenger and auto-carrying vessels. Of the eleven new craft to be completed this year, nine of them are fitted with the Diesel-electric propulsion. In view of the many years' experience obtained with various types of steam propulsion, together with the pioneer experience with the Diesel-electric Drive, the present indications give promise of a bright future for the continued adoption of efficient ferry boat propulsion procured by the use of direct current motor driven propellers, deriving power from Diesel driven generator units.

The six new Southern Pacific Diesel ferries, preliminary particulars and drawings of which were published in July 1926 MOTORSHIP, are to be operated on two individual routes, one from San Francisco to Oakland pier on the Southern Pacific automobile ferry route, a distance of approximately 3.6 miles, and the other over the Northwestern Pacific from San Francisco to Sausalito, a distance of approximately 6.75 miles. We are informed that three of the new ferries will be used on the Oakland run and three on the Northwestern Pacific run.

At the present time a 15 minute schedule is maintained on the Oakland run and about 20 minutes is required to make the passage from San Francisco to Oakland. It is expected that when all the new ferries



*Dual steerers in pilot houses*

are put in service, that a 10 minute schedule will be in operation, thus relieving the great congestion now existing between San Francisco and Alameda counties. The Northwestern Pacific run is greatly in need of additional automobile ferries during week ends and holidays and two new boats would greatly expedite automobile travel between San Francisco and Marin Counties. The average time required to cover the route one way is 35 minutes.

As this is the first venture on the part of the Southern Pacific Company in Diesel motor ferries, an exact comparison of fuel consumption of Diesel with steam, is not available but it is estimated that a saving of approximately $4.35 to $5.40 per hour, will be effected by the use of Diesel electric drive. A saving of $5.00 per hour would mean $80.00 saving in fuel in a 16 hour day.

### Characteristics of Southern Pacific Ferryboats

| | |
|---|---|
| Length overall | 256 ft. 0 in. |
| Length b. p. | 234 ft. 0 in. |
| Beam molded | 44 ft. 10 in. |
| Beam over guards | 63 ft. 6 in. |
| Depth at center | 19 ft. 9 in. |
| Capacity of automobiles | 95 |
| Power Diesel engines (total) | 1700 b.hp. |
| Power electric motors (each) | 1250 s.hp. |

MS. FRESNO has a steel hull and is built on fine, fast lines which should guarantee speed at economical power. The decks are arranged to provide simple but effective ventilation. The engine rooms are most efficiently arranged to provide simplicity of operation. From stem to stem the vessel gives evidence of the care which has been exercised to provide comfort and simplicity.

The hull, built on the transverse system of framing, is subdivided into eight watertight compartments. The two midship compartments are used for engine and motor rooms, two engines and one motor being in each room. The compartments adjacent to the engine rooms are provided with fuel and fresh water tanks. One 108 bbl. fuel tank and one 108 bbl. fresh water tank, are installed in each compartment. Engineers' quarters and three store rooms occupy the remaining compartments.

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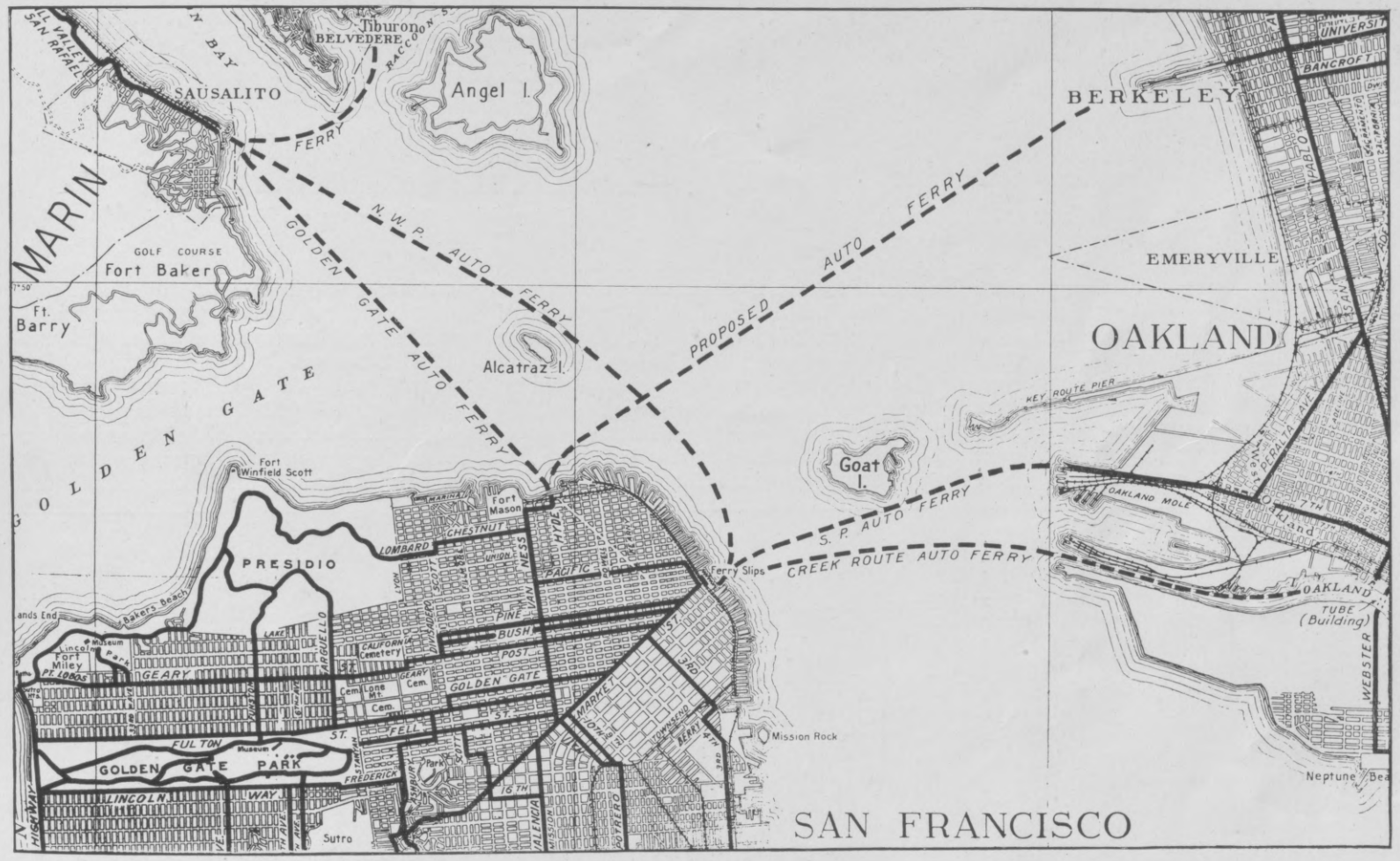
The engine spaces are plated over and are provided with steel casings carried up above the saloon deck. Both the main and saloon decks are of wood. The sides of the superstructure, housing the automobiles, are of steel amply provided with large steel-framed windows. Four stairways built into the engine room casings, lead from the main deck to open spaces on the saloon deck. This design permits of effective ventilation of automobile gases from the main deck to the atmosphere.

On the saloon deck are built three separate deck houses. A square-shaped steelship bulkhead. New London Ship and Engine Co. Croton, Conn., has supplied a total of 24 engines of this type for the new Southern Pacific fleet. A General Electric double armature self-ventilated, 1250 hp. motor is between the two engines close to the opposite bulkhead. This plan is also adhered to in the other engine room so that the leads from the generators and exciters are brought up to the switchboard flat attached to the midship bulkhead above one set of exciters. The engineer's desk, gage board and control station are also located on this flat.

Outboard of the other main engine, in the switchboard engine room, are installed a motor-driven Northern auxiliary fuel oil service pump, a motor-driven Northern auxiliary lubricating oil pump and a Byron-Jackson motor-driven sanitary pump.

Two Frigidaire ice machines are also installed in the engine room. These machines furnish refrigeration for the ice box installed in the galley and the frost coils submerged in the drinking water circulating system. This method eliminates hand icing and preserves the food in the ice boxes when the ship is not in operation.




*Auto-ferry routes in San Francisco harbour are served by Diesel-electric ferries on important transportation lines*

enclosed room contains four Maxim silencers and the hot water circulating system. The exhaust gases in the lower portion of the mufflers are used to heat fresh water within radiators. This hot water is circulated continuously throughout the hot water systems by a motor-driven centrifugal pump. Make-up water is provided by a tank located near the main stack above.

Wooden deck houses are built on each side of the muffler room. The galley, restaurant and men's smoking room are arranged in one of these houses. The other deck house provides the lavatories, main cabin and ladies' room. The ladies room is located on the fore end of the saloon deck and is most comfortably appointed within rounded walls, forming an ideal observation space.

A simple engine room layout provides maximum accessibility. In one engine room, two Nlseco, 450 b.hp., 6-cylinder, airless injection Diesels are installed with the generators and exciters facing the mid-

On the same level as, and outboard of the switchboard flat, a Sterling 4-cylinder gasoline engine, direct connected to a 60 kw. 125 volt, 1200 r.p.m. General Electric generator, is located. This set is to be used for emergency purposes and will provide sufficient power for operating the fire pump or emergency air compressor.

Outboard of one engine in the same engine room, on the main floor plates, is located a Northern fire pump of 500 gal. per min., capacity at 125 lb. pressure. This is direct-connected to a 50 hp., 115 volt marine-type General Electric motor. There is also a Northern auxiliary circulating water pump of 250 gal. per min. capacity at 30 lb. pressure, direct connected to a 12 hp., 115 volt marine-type General Electric motor.

Each main engine carries its own circulating water, lubricating oil and fuel oil service pumps. These pumps are driven by gearing and cranks from one end of the main crankshaft.

In the other engine room are located the two motor-driven Rix, two-stage air compressors. Directly above these compressor sets are located the two starting air tanks and the whistle air tank. The entire air system is thereby centralized outboard of one main engine unit. A duplicate Northern fire and bilge pump is placed outboard of the other main engine. Both fire pump units are on the same side of the ship close to the midship bulkhead, thus simplifying valves and water connections.

The four exciter circuits are divided so that one 40 kw., 125 volt exciter furnishes excitations for the four main generators thereby controlling the voltage at the motor terminals according to the Ward Leonard System. Another exciter of the same capacity provides power for the engine room auxiliaries, lighting, etc. and the third unit supplies power and heat for the galley, dining room, etc. The fourth unit is a standby available in an emergency.

Each engine is provided with an indi-

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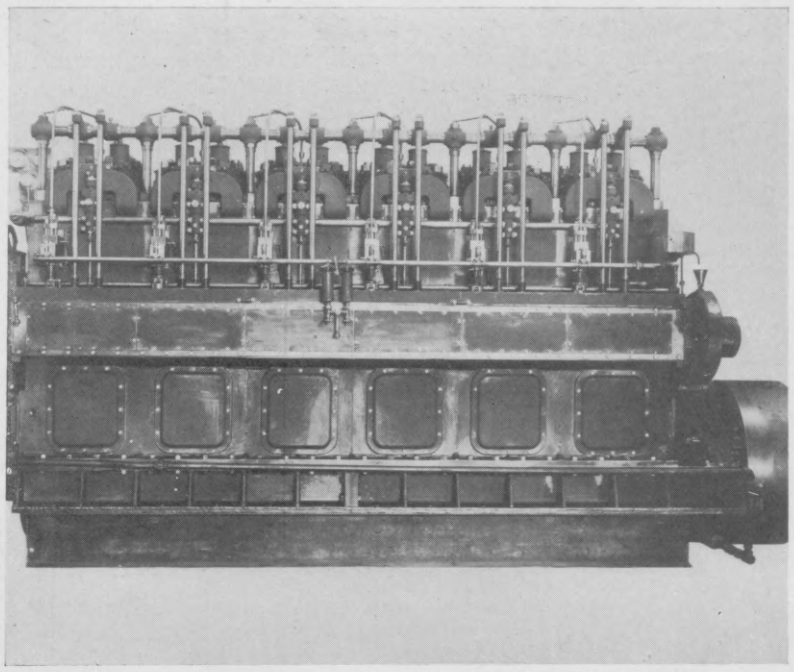
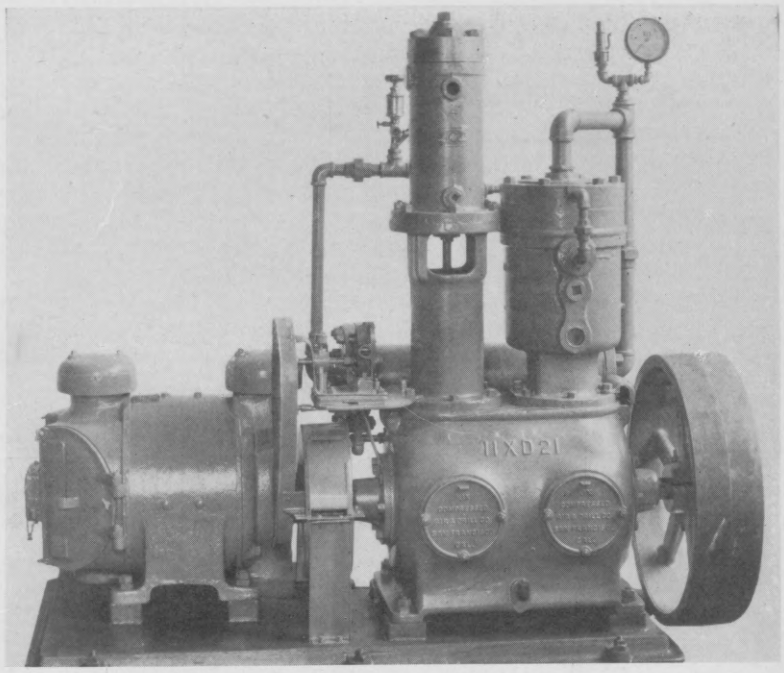


*One of the main Nlseco 450 hp. Diesels*



*Motor driven Rix 2-stage air compressor*

vidual fuel and lubricating oil tank. Each unit, therefore, is a separate power plant equipped with tanks and auxiliaries entirely independent of any other unit.

The steering engines are of the Cunningham straight electric quadrant type, motor-driven. The deckhouse is provided with a Sperry dual steerer of the standard wheel type. Direct reading helm indicators are placed on the top of the stands. These indicators take their motion directly from the rudder-head mechanism.

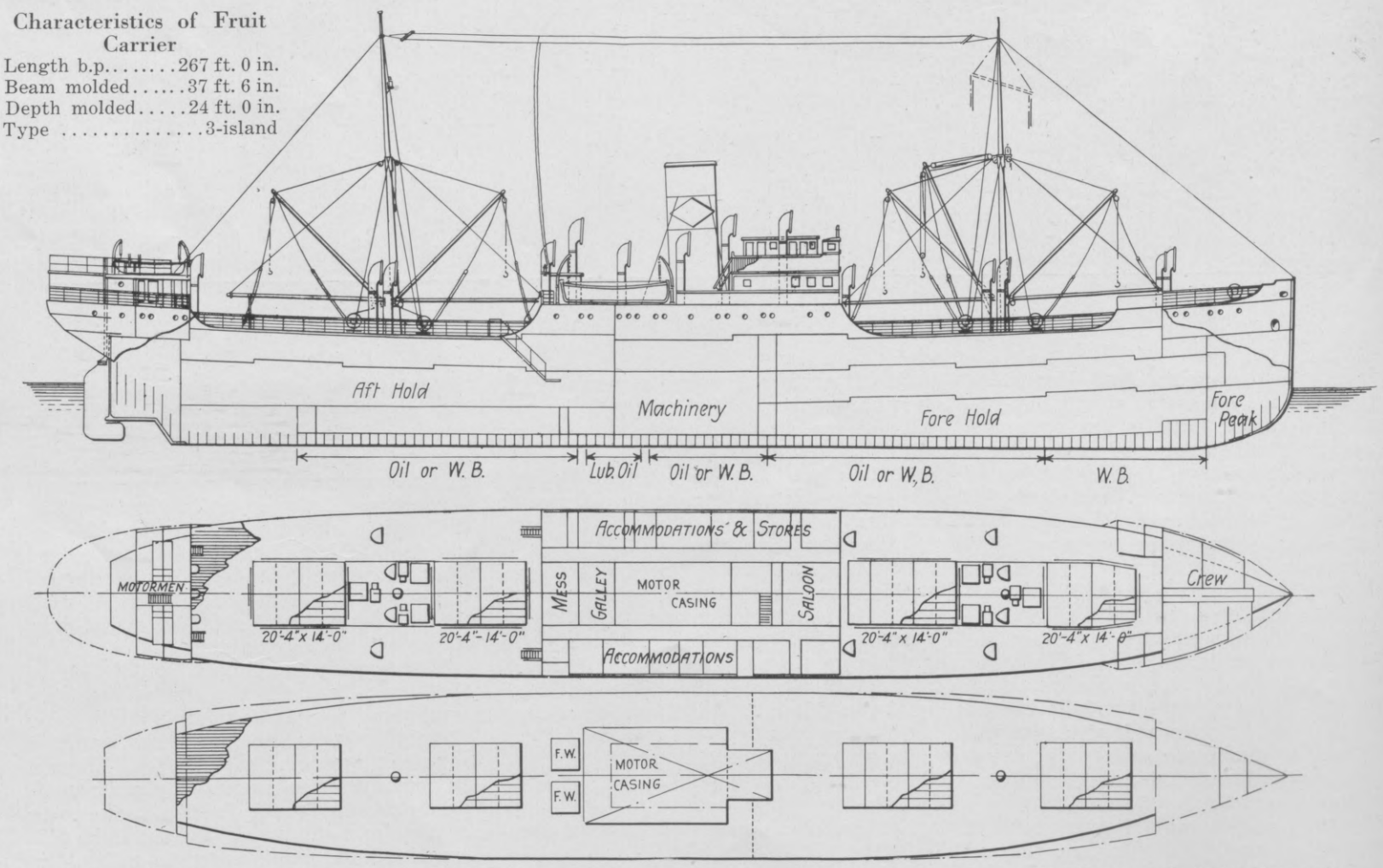
A Ward Leonard control station is placed in each pilot house as well as in the engine room.

No centrifugal purifiers are provided on board the ship as the fuel and lubricating oils are to be properly conditioned ashore. A centrifuge plant is being built close to the "tie-up" dolphins for the purpose of purifying the fuel oil and removing water, sand and foreign matter before placing the fuel aboard the ferries. At definite intervals the used lubricating oil from the sump tanks of the vessels, will be pumped to an ashore tank for purification. Purified lubricating oil will then replace the used unpurified lubricating oil. The vessels are further equipped with Sperry visible air whistles and two 12 in. Sperry searchlights.

## A 14-Knot Diesel Driven Fruit-Carrying Vessel of 2400 Tons d.w.c.

**Characteristics of Fruit Carrier**

Length b.p.....267 ft. 0 in.
Beam molded.....37 ft. 6 in.
Depth molded.....24 ft. 0 in.
Type .....3-island




*Titchfield Shipping Co., Oslo, take delivery shortly of this fruit carrier for United Fruit Co. charter. She has been built by Gotaverken, Gothenburg, and is engined with two 6-cylinder 1300 hp. Gotaverken B. & W. Diesels which give her a 14-knot speed*

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# Tanker Chestnut Hill to Be Converted

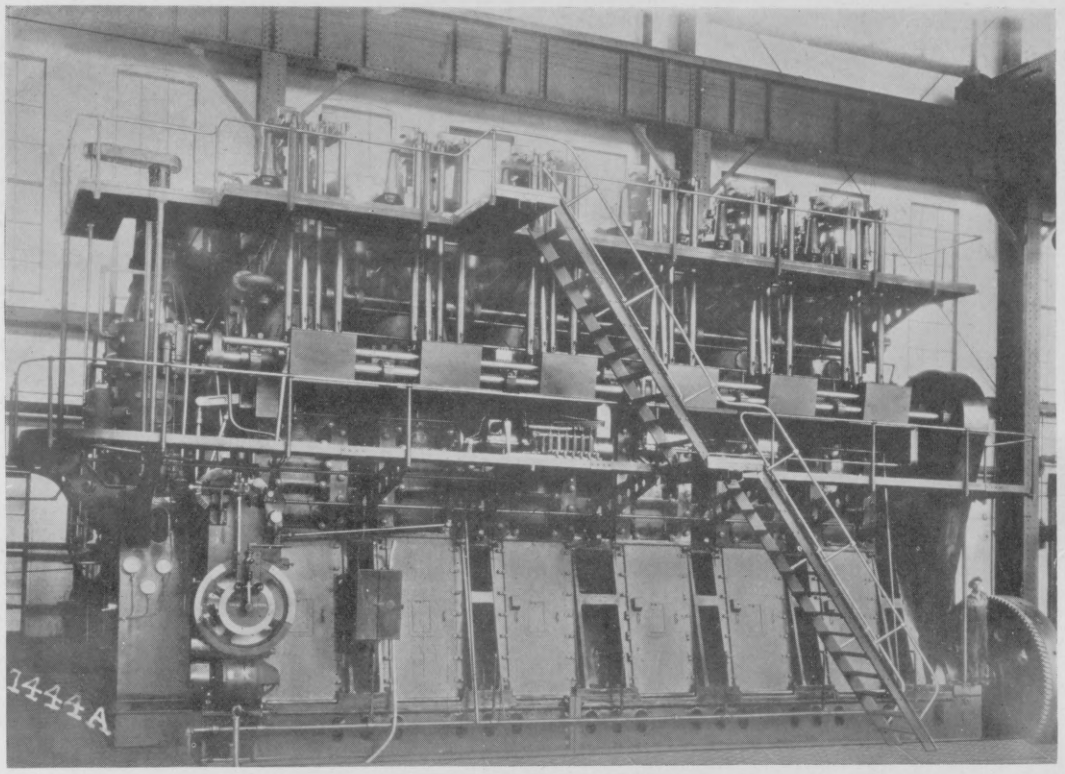
## Anglo-Chilean Consolidated Nitrate to Fit McIntosh & Seymour Diesel in Ship to Carry Fuel Oil to Tocopilla

BIDS are to be opened on or about May 15 for the installation in the Shipping Board tanker, CHESTNUT HILL, of an 1800 hp., 6-cylinder McIntosh & Seymour Diesel engine. CHESTNUT HILL was sold recently to the Anglo-Chilean Consolidated Nitrate Corporation of New York for the sum of $57,000, the purchaser being required under the terms of the sale to convert the vessel to direct Diesel propulsion. Announcement of the sale has already been made in MOTORSHIP.

The McIntosh & Seymour engine in question is at present complete but for one or two minor modifications which will be made in the Auburn shops. The engine will then be ready for shipment to the vessel for installation, as soon as the installation contract is let. The engine has 6 cylinders, 29 in. diameter by 48 in. stroke, and it is expected that it will give the vessel a speed of about 10¼ knots when running at 105 r.p.m.

When completed, the ship is to run between San Pedro, Cal., and Tocopilla, Chile, carrying fuel oil for the power plant of the Anglo-Chilean Company, which is run by 7 M. A. N., Diesels, coupled to A. E. G. generators. The Diesel engines develop 10,000 hp. collectively, and are used for supplying current for the company's plant, and also for driving locomotives on the railroad from Tocopilla part of the distance to the nitrate plant at Coya Norte some distance inland.

Tocopilla, like most ports on the western South American seaboard, is an open roadstead, and tankers unloading at this port are required to be moored stern on to the shore pipe line. CHESTNUT HILL, when converted, will pump her fuel oil into large tank storage facilities situated near the water edge.




*The 6-cylinder 1800 hp. McIntosh & Seymour Diesel to be installed in the tanker Chestnut Hill*

### Characteristics of Chestnut Hill

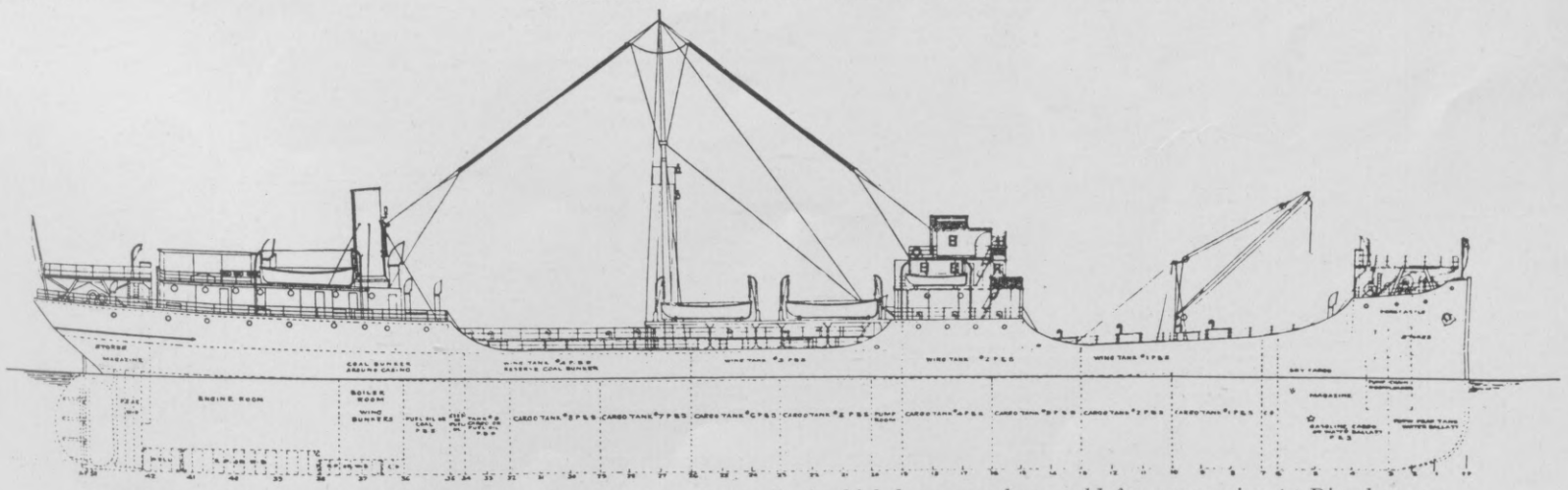
| | |
|---|---|
| Length b.p. | 365 ft. 0 in. |
| Beam, molded | 50 ft. 9 in. |
| Depth, molded | 31 ft. 3 in. |
| Draft, load | 24 ft. 5 in. |
| Displacement, at above | 10,225 tons |
| Total capacity main tanks | 51,516 bbl. |
| Total capacity summer tanks | 5,922 bbl. |
| Dry cargo capacity | 48,170 cu. ft. |

In taking out the existing steam machinery and substituting Diesel machinery, considerable alterations have naturally to be carried out, and the whole of this work is being supervised by Angelo Conti, whose connection with the Shipping Board Diesel program is well known. The owners will have the existing machinery of the ship completely gutted, and all of the existing machinery removed. In the new layout the machinery attendant on sea operation of the ship is to be electrically driven, current for this purpose being supplied by two auxiliary compressor-generator sets of 100 kw. capacity. Each of these engines is a standard McIntosh & Seymour 13 in. by 18 in. unit. The present existing arrangement for electric power on the ship comprises the generation of alternating current. The arrangement planned for the conversion will change this to direct current.

A Scotch donkey boiler will supply steam at about 125 lb. per square in. for heating the cargo tanks, for heating the ship, and for driving the anchor windlass and winches for the cargo hold forward and warping.

The cargo pumps which are of reciprocating type, will be driven by electric motors as at present, but this, of course, will be changed to modern direct current totally enclosed units.

The 7000 ton d.w.c. tanker BRANDYWINE sister ship to the CHESTNUT HILL has been purchased from the Shipping Board by a New York company, whose name we have been requested not to publish at this time. BRANDYWINE will also be converted.



*Profile of the Chestnut Hill type Shipping Board tankers, all of which have now been sold for conversion to Diesel power*

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# Sea-Going Hopper Dredge "Willets Point"

## Discussion on Novel Features Incorporated in New Vessel's Design and Construction Continued from the April Issue of Motorship

By Northrop R. Fletcher*

THE hopper space is divided by transverse bulkheads into three bins with a total capacity of about 1,170 cu. yds. The sides of the bins or hoppers slope to the six doors in the bottom of the ship. These doors are of cast steel and are set in cast steel frames riveted to the plates and structure of the ship. In each frame are two lined ports connected with the 12 in. suction and flushing lines that run longitudinally on either side of the ship. At the forward end the two suction pipes are tied in with a gate valve to tee in the suction of the port dredge pump. Aft, the flushing lines are tied together and fed by two large sea chests. The flushing line provides the excess water necessary to make the mud fluid enough to be handled by the pump and forced through a long shore pipe. Gate valves are provided for both connections to each hopper. In actual practice on one particular dredge it has been found that the material packs so hard at the bottom of the hoppers that additional agitation is necessary before the mud will go through the suction pipe. To produce this agitation on WILLETS POINT high pressure jets with tool steel nozzles are installed on all sides of the door frame.

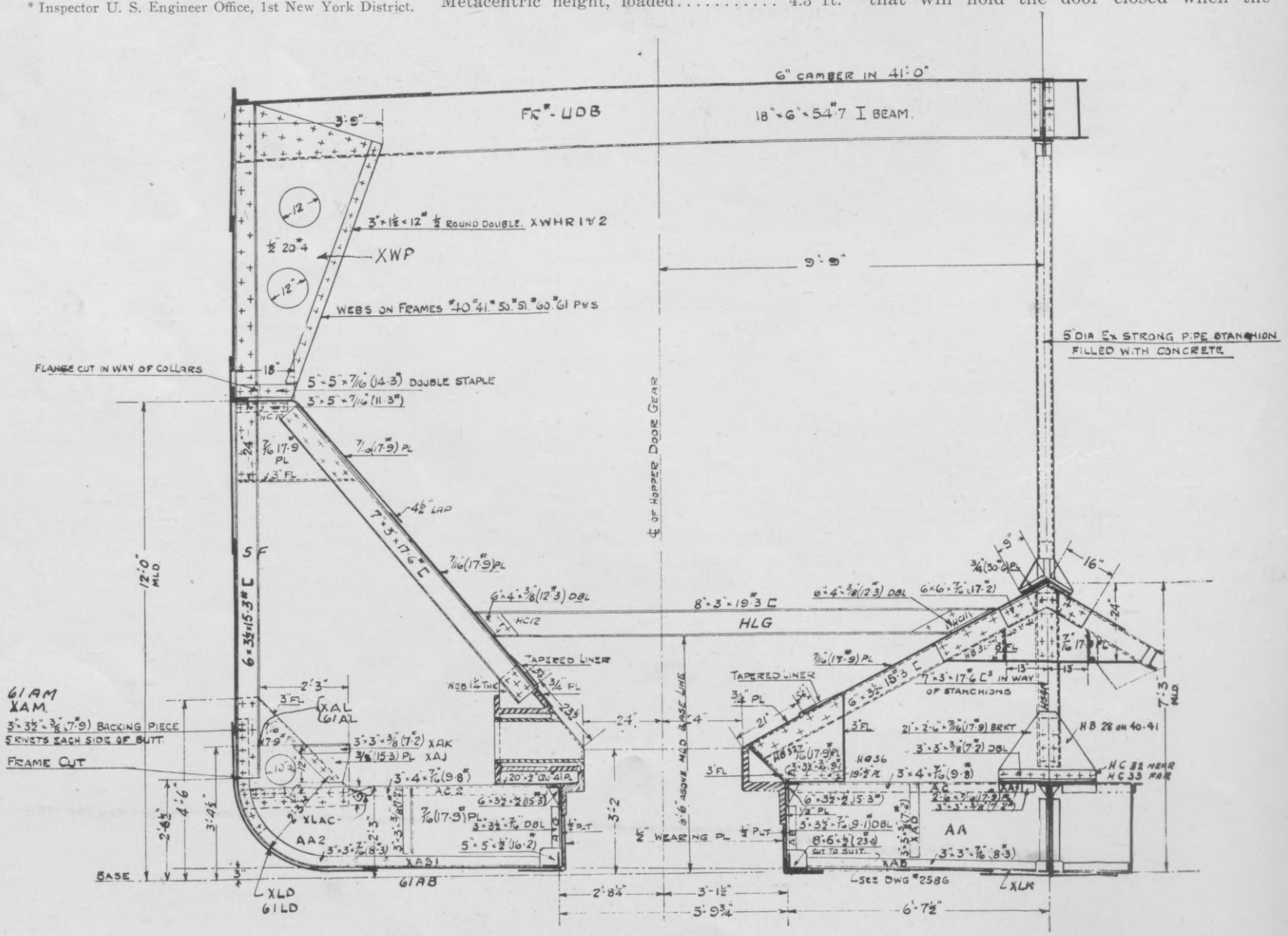
The doors themselves are about 4 ft. square and are hinged to their frames. When in an open position these doors drop into wells and extend about 2 ft. below the bottom of the hull.

The doors are raised and lowered by hydraulic cylinders standing vertically above the hopper space. These cylinders are of heavy cast steel reinforced with heavy vertical ribs. The bore is 8 in. and the stroke 52½ in. The piston rod is connected by flanges to a 3½ in. rod guided by a bracket across the hopper above the door and connected to the door by links. This rod is provided with a turnbuckle for adjustment and with a cross arm or tee near the top for a mechanical locking gear that will hold the door closed when the

* Inspector U. S. Engineer Office, 1st New York District.

### Characteristics of "Willets Point"

| | |
|---|---|
| Length overall | 200 ft. 2¼ in. |
| Length b.p. | 193 ft. 0 in. |
| Breadth, over fenders (drags removed) | 42 ft. 6 in. |
| Depth, molded to main deck | 19 ft. 6 in. |
| Draft, mean, salt water loaded | 16 ft. 5 in. |
| Draft, mean, light (hoppers dry) | 7 ft. 11 in. |
| Draft, mean, light (hopper doors open) | 9 ft. 1 in. |
| Displacement, loaded, salt water | 2966 tons |
| Displacement, light | 1300 tons |
| Gross tonnage | 1164.85 tons |
| Hopper capacity (three hoppers) | 1170 cu. yds. |
| Speed, loaded, estimated | 10 m.p.h. |
| Speed, light, estimated | 10.5 m.p.h. |
| Metacentric height, light (hoppers dry) | 20.28 ft. |
| Metacentric height, light (hopper doors open) | 10.22 ft. |
| Metacentric height, loaded | 4.3 ft. |




*Section through hopper spaces of sea-going hopper dredge "Willet's Point" shows methods of construction employed and scantlings of hull members*

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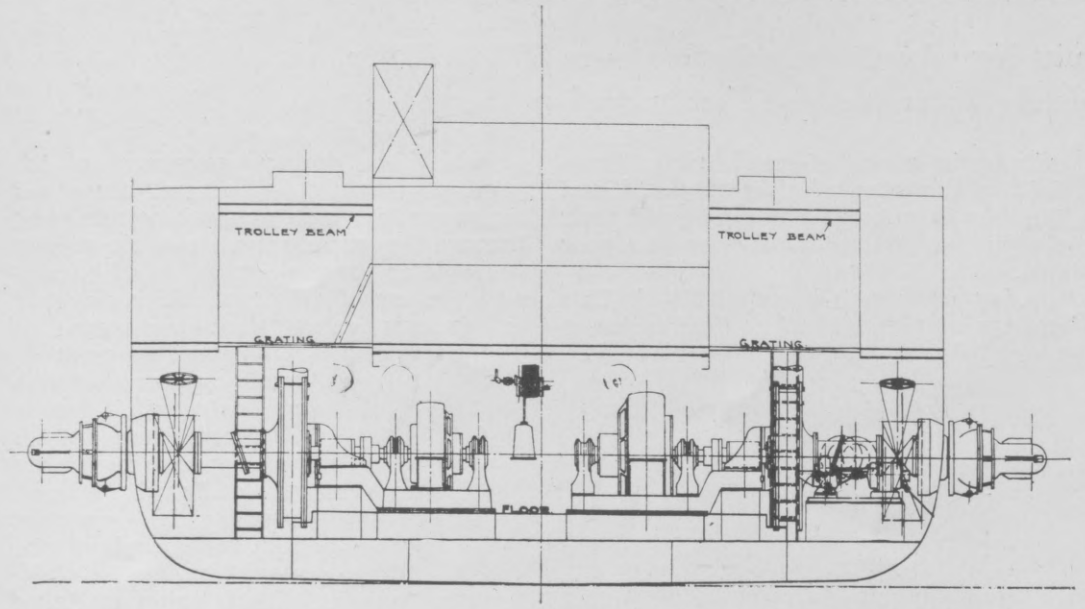
pressure is dropped in the cylinder or when the cylinder is dismantled. The piston is fitted with follower rings and heavy leather cup washers. A hollow cast steel skirt is fitted to the bottom of the piston to cushion the action of the gear at the bottom of the stroke. Two ports are provided at the bottom of the cylinder, one 4½ in. above the other. On the down stroke, oil is discharged through the upper port to the sump until this port is closed by the piston skirt. A check valve in the lower pipe prevents further discharge, while the remaining oil and air trapped in the skirt cushion the stroke. Oil for raising the gear is admitted through the check valve and the lower port until the upper port is uncovered.

These gears are operated from the bridge by piston valves arranged to operate with levers and to raise or lower the two doors of one hopper together. An additional lever is provided to operate the three valves simultaneously.

Pressure for the hydraulic gear is provided by two Hele-Shaw pumps originally installed on one of the Diesel-electric dredges for the same purpose. These pumps discharge into a pressure accumulator tank of 300 gal. capacity. Pressure is maintained by controls starting the pump motors when the pressure falls to 300 lb. per sq. in. and stopping them when the pressure rises to 400 lb. These devices were furnished by the Cutler-Hammer Company and consist of contacts mounted on the dial of a conventional, Bourdon tube type pressure gage connected with a relay to the control circuit of the magnetic control panel for the motor.



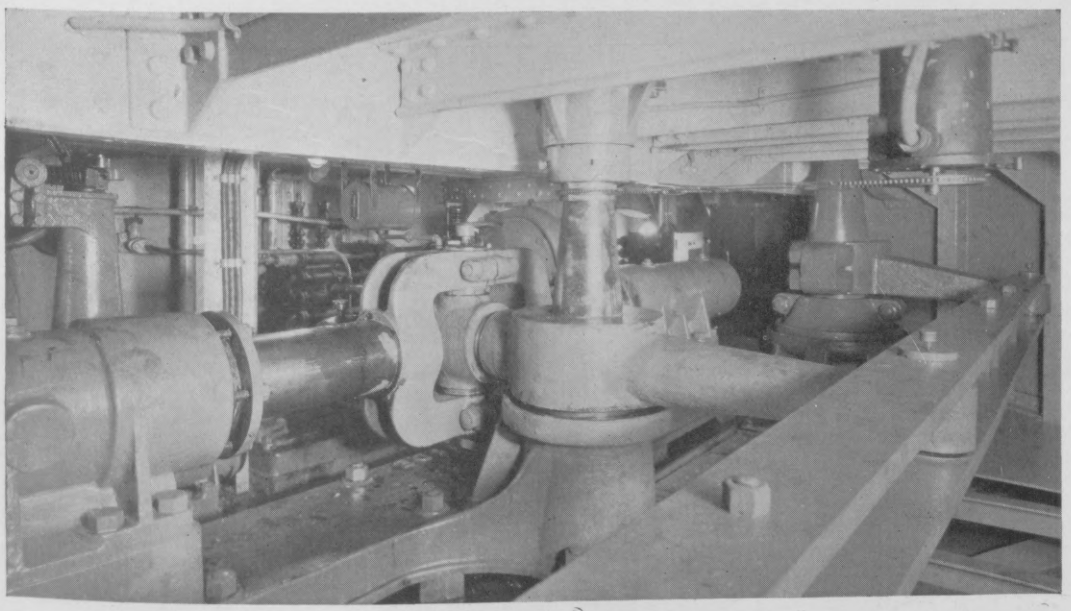

*Sectional view showing arrangement of pump motors and dredge pumps*

All parts, piping, controls, tanks, etc., of the hydraulic system are designed to withstand a much higher pressure than that used. In case it is found that the hydraulic cylinders are not powerful enough to hold the doors closed, it will be a simple matter to change the settings of the control switches and increase the operating pressure. So far, preliminary trials have shown the gear to be very satisfactory. It will be quite a saving in labor for the mate on watch or the quartermaster to be able to dump the dredge without leaving the bridge. As a matter of fact, the whole boat has been made as nearly "one man control" as is practicable at the present stage of mechanical development.

Another new feature has been incorporated in the drag winches and the drag winch controls. An automatic tension control gear is used. This gear, which was designed by the Lidgerwood Company who built the winches, is so arranged that a constant tension can be maintained on the drag hoist wires. This is another device that has been added to simplify the operation of the dredge and make the work more efficient. In digging, the drag must bear on the bottom of the channel with a certain weight in order to agitate the material. In hard sand and heavy clay the pressure must be great, but if the material is soft the drag head must be supported by the winch or it will bury itself and become choked. It is evident that as the boat moves along, the drag must be raised and lowered with slight changes in depth in order to maintain the necessary pressure and consequently necessary tension in the hoist line. For this purpose a "drag tender" or operator is stationed with winch controls in a cab near the side of the dredge where he can watch the drag pipe, the discharge from the pump, and a spring at the top of the drag hoist davit. This coil spring, supporting the sheave for the hoist line, serves as an indicator of the pressure of the drag on the bottom of the channel. WILLETS POINT is equipped with manual master controllers in the drag tenders' cabs so that the operators can raise and lower the suction pipes as described above.

With such a method of operation the human element enters again. The man must watch the coil spring and the discharges, and then decide if the line should be slacked or pulled in. During this time, lag of the human brain, conditions at the drag head may change materially. Again, the operator's judgment may be poor concerning the amount of solid coming from the pipes, the amount of motion of the spring or of the amount of line that he is playing out with the controller. If the operator cannot maintain a uniformly heavy discharge to the hoppers through uniform conditions of the drag head much time is lost in pumping water, and solid is washed from the hoppers by this water. Economy of operation demands that the greatest number of cubic yards of solid material be deposited in the hoppers per minute of pumping. The automatic drag winch control aims to do this by maintaining a uniform tension on the drag hoist line. As the channel becomes shallower the drag will bear upon the bottom, the line will slack and the winch will pull in on the line until the desired tension is obtained. In a deep spot the winch will play out until the tension is again at the desired value.

*(To be continued)*



*Twin cast rudders are controlled by special steering gear*

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Stoomvaart Maatschappij Nederland has placed an order with Sulzer Bros. for four Diesels of 9,000 hp. and 16 auxiliary motors for four new 14-knot freighters.

This company has several motorships equipped with Sulzer Diesels, one of which BINTANG, a converted steamer, has covered over 80,000 nautical miles in the Amsterdam-Batavia trade. It is due to the satisfactory service of the motors now in use that this repeat order has been placed.

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Six large Diesel driven ferry vessels are to be built for the Municipality of Amsterdam, Holland.

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# Hill Introduces New Model Diesel

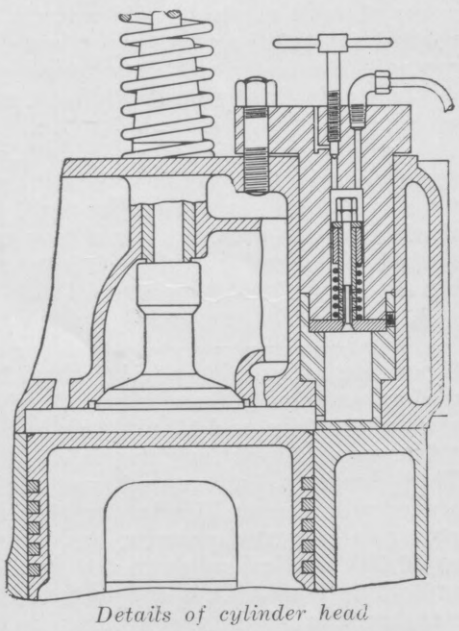
## High Speed Units Now Available in Powers from 50 to 125 Hp. with Completely Water Jacketed Precombustion Chamber

HILL Diesel Engine Company, who have during the past 6 years built a line of small Diesels ranging from 6 to 30 hp. in 1 to 4 cylinder units, are now making 6 in. by 10 in. new 4 and 6-cylinder models, developing from 50 to 125 hp. at speeds from 400 to 900 r.p.m.

Constantly widening fields for the Diesel engine have developed a demand for engines capable of much higher speeds and greater flexibility with less weight, and the characteristics of this new model seem to qualify for a great variety of service not heretofore well covered.

In the marine field especially there has been some hesitation to adopt Diesel power for the medium and small workboats and yachts, because of an unwillingness to surrender the required space, and much gasoline is still consumed where Diesels would do the work at one-eighth the cost.

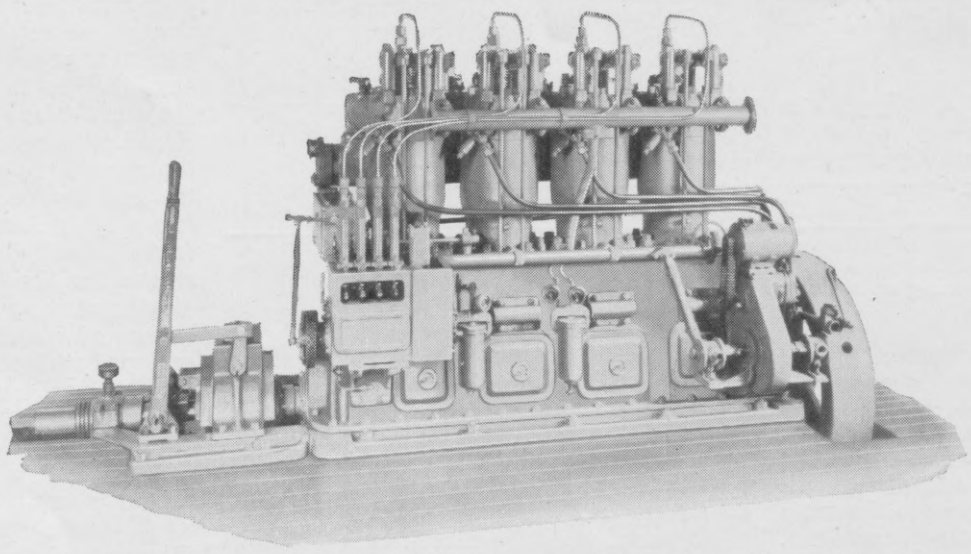
The new Hill model employs a completely water-jacketed precombustion chamber, into which fuel is sprayed in a finely divided state. Here ignition occurs and combustion is carried far enough to increase the pressure above the compression pressure and to project the resulting gas into the cylinder with great force, where combustion is completed. A much larger size precombustion chamber in proportion to the cylinder volume is used than the cups



*Details of cylinder head*

or chambers used in the early Hill engines, resulting in a much higher injection pressure for forcing gas into the cylinder. No effort is made in the new design to restrict the flow of gas from the chamber to the cylinder by means of small holes. Three 5/32 in. diameter holes are employed, and there is, therefore, no possibility of their plugging, regardless of overload or poor fuel.

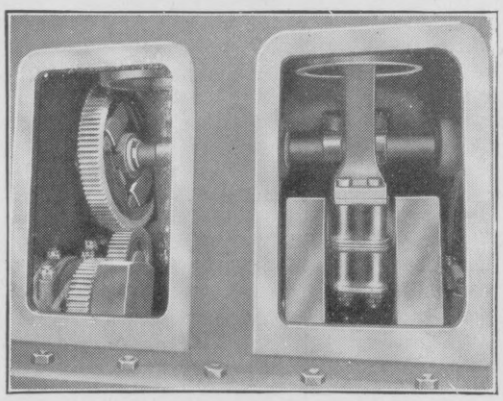
A low-pressure fuel nozzle is fitted. This employs a spiral and large final orifice to break up the fuel, instead of the minute holes generally used. The complete fuel valve may be removed while the engine is running, which is a valuable point, and a substantial filter protects each nozzle from dirt.



*The new 4 cylinder Hill-Diesel shows a rugged, workmanlike outline*

Conventional design has been adopted for the injection pumps, and these have hardened steel cylinders and lapped plungers operated by a hardened steel cam shaft. Large hardened steel rollers mounted on swinging levers transmit movement to the plungers. The output is controlled by graduating the stroke through levers and an eccentric shaft. The pump is so designed that a complete cylinder with its valves and plunger may be removed and replaced while the engine is running. The maximum pressure under which the pumps operate does not exceed 1000 lb. per sq. in.

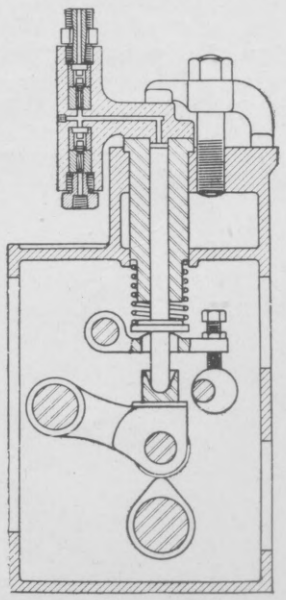
The governor, mounted in the secondary gear, is of flyball type, and an oil pressure-operated regulator is interposed between the governor and the fuel pumps, by means of which the slightest movement of the governor is multiplied several times and the power increased as much as necessary to move the control eccentric on the pumps. A regulator power device of this type permits the use of a light sensitive governor and insures instant positive response by the pumps to great or small changes of engine load or speed. Changes of speed from 200 to 900 r.p.m. are taken care of by a hand lever, leaving the governor still in control of the regulation.



*Crankcase covers removed*

Fuel injection takes place during the compression stroke, the time depending upon the nature of the fuel and the speed of the engine. And, with the above combination of precombustion chamber, spray nozzle, pump, regulator and governor, all the functions are in full control of the operator over the entire range of speeds required in service.

Engineers who have experimented with high-speed Diesels and know the difficulties surrounding the measurement, injection, atomization and complete combustion of minute quantities of fuel in the infinitesimal space of time available at the speed of 900 r.p.m. will appreciate the importance of the arrangement. At full load, the fuel consumption of the new engine is 0.48 lb. of 18,500 b.t.u. fuel per hp. hr., with an exhaust temperature of not more than 550 deg. Fahr.



*Fuel pump details*

Full forced feed lubrication is provided for all principal bearings through drilled channels in the crank and tubes in connecting rods. A rotary oil pressure pump

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draws oil from the storage tank and discharges through a filter to the distributor header within the base, while another rotary pump keeps the base drained of oil and discharges into the oil storage tank. Fresh oil is supplied to the cylinders by a force feed lubricator.

Circulation of cooling water in the engine is carried out by a bronze rotary pump, while another handles bilge-water. The two latter pumps are interchangeable. Provision is also made for a fuel transfer pump when required. All the pumps are built in and driven by housed gears, which receive lubrication from within the base.

The air-starting distributor is driven from an extension of the cam shaft and supplies air to all cylinders. The air starting check valve, cylinder pressure relief valves and indicator connection are combined in a single unit secured to the cylinder head by studs and these may be easily removed for grinding when necessary. An air inlet manifold is provided, having pipe flanges to connect to a filter or outside if desired.

The exhaust manifold is completely water jacketed and all the discharge from the cylinder jackets passes through it. Openings for thermo couples and inspection plugs are provided in the exhaust outlets of this new design.

Bronze back, babbitt-lined main and crank bearings are used, and these may be rolled out for inspection or replacement. The pistons are extra long and are designed so that they may easily be withdrawn through the openings in the base. Marine type connecting rods are used, 2¼ times the length of the stroke.

Exhaust valve levers are mounted on eccentrics with lever handles, so that the compression may be relieved on one or more cylinders when necessary.

The operation of the engine is remarkably smooth and free from vibration at all speeds and reflects very creditably on the designers' progressive ideas.

# Large Diesel Dredge Ordered for Panama Canal

AWARD has been made to the Ellicot Machine Corp., Baltimore, Md., for the construction of the 24-in. Diesel-electric hydraulic dredge for the Panama Canal whose preliminary characteristics were outlined in MOTORSHIP'S January 1927 issue. The dredge is to be delivered at Cristobal C.Z. at a total price of $1,042,600 including spare parts and refrigerating machinery. The hull has a length molded of 226 ft., a beam molded of 50 ft., and a depth molded of 14 ft. The dredge is powered by four 900 hp. Fulton Diesels coupled to Westinghouse generators. These three units will supply current for an electric motor driving a centrifugal, single-suction pump, with 26 in. diameter suction and 24 in. diameter discharge.

Heavy duty will be required of the vessel, and she is to have an output of 2200 cu. ft. per min. of a mixture of water and solids, with an average density of 75 lb. per cu. ft. She is designed for operation in the Panama Canal or adjacent waters, either fresh or salt, and is required to dredge to a depth of 60 ft. and to deliver into a floating discharge pipeline. Furthermore, the vessel must be able sufficiently to dredge in one swing a cut 250 ft. wide at the full depth of dredging.

All the hull dimensions are a minimum to accommodate the dredging machinery required for these conditions. Transverse framing is adopted with the spacing not greater than that required by the American Bureau of Shipping, while shell plating is to be 5 lb. per sq. ft. heavier than that required by the same body. Deck and bulkhead plating is to be in conformance with American Bureau's requirements.

Hull shape is, in general, in conformity with that of most modern pipeline dredges. Bilges are rounded and a square stern fitted, except that the stern corners are to be rounded to a radius of over 24 in. The stern will also have a rake ending 4 ft. vertically below the main deck to facilitate towing. The bow is to be tapered to facilitate dredging at close quarters against a vertical bank. Two longitudinal watertight bulkheads are to be worked into the hull structure, each 7 ft. from the side plating. The general aim in addition to providing a strictly strong and stiff hull, is to provide against disaster to electrical or other machinery by reason of rupture of hull pump casing or pipelines. For this reason the main dredge pump, the main driving motor and each pair of the four prime movers, together with their corresponding generators and exciters and the main switchboard, are placed in separate compartments, watertight at bottom and sides. Furthermore, no doors are used in the bulkheads between these compartments. A double bottom is to be installed under the main motor, the switchboard and the two Diesel engine rooms.

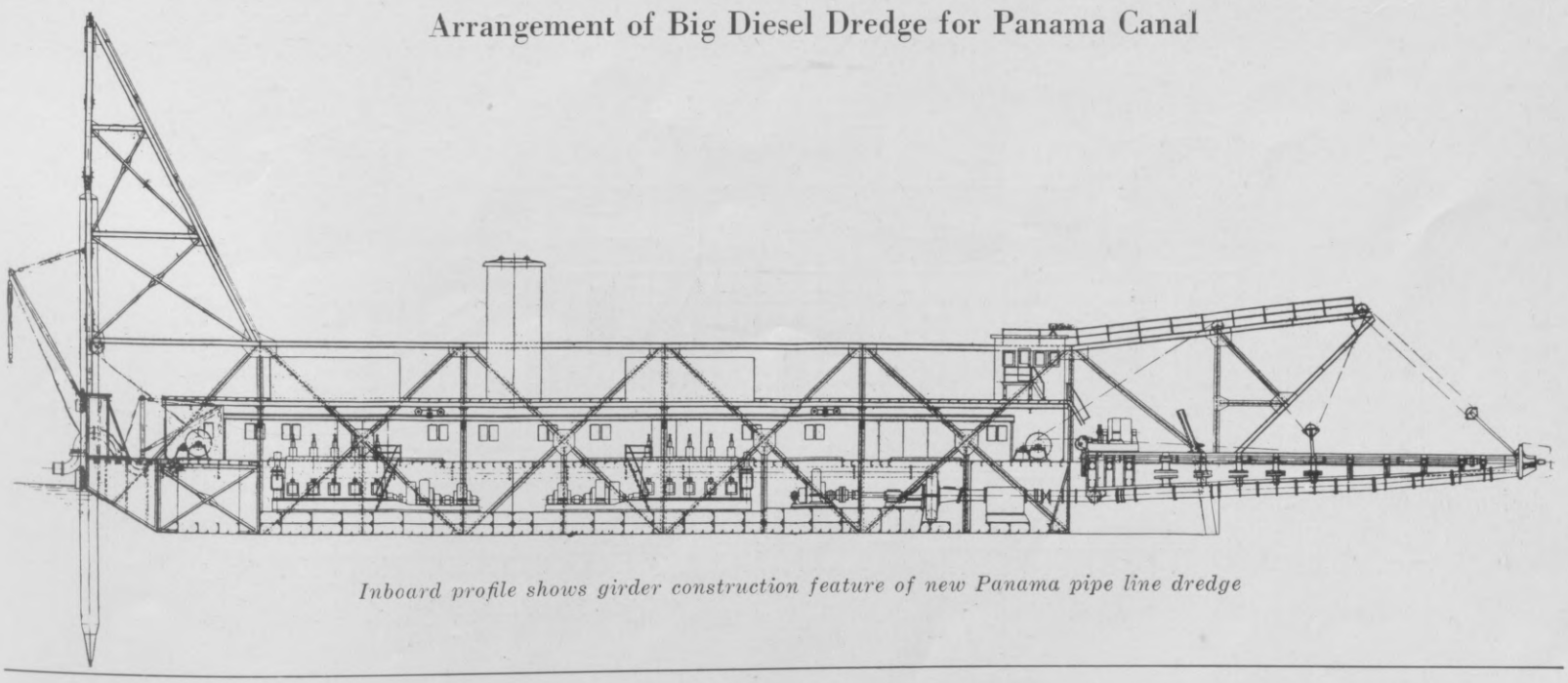
Machinery wells are covered by a steel house with steel roof, the height of which depends on the head room required for handling ordinary repairs and parts with the traveling crane. A walkway 7 ft. wide on the main deck around this house is arranged at the forward end on top of this roof, which forms a deck where the operating room will be located. In this room will be complete control of all operations of the dredge except that of the main Diesel engines and auxiliary pumps. A master gage board will be located here and will contain indicators for all necessary control.

Living quarters for crews will be on the second deck abaft the operating room.

The spuds are to be square in section and of suitable strength and size for operating in a 3-knot current, allowing also for standard wind loads.

The main switchboard, which will be located in a separate watertight compartment, is to be of dead front type, with the main generator and auxiliary generator switches operated by hand wheels on the front of the panels. A 230 volt cutter motor of watertight, separately ventilated type, is of sufficient horsepower rating to drive the cutter continuously under the dredging operations specified.

## Arrangement of Big Diesel Dredge for Panama Canal



*Inboard profile shows girder construction feature of new Panama pipe line dredge*

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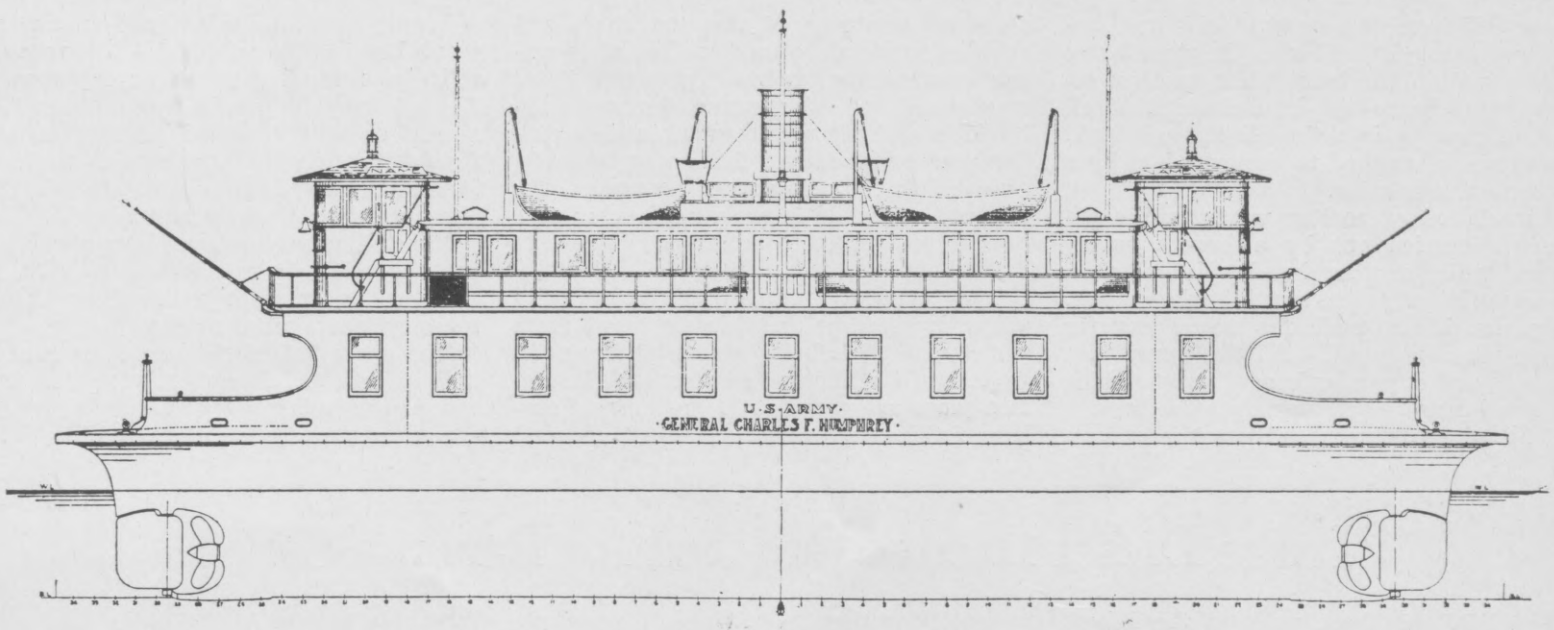



# War Department's New Diesel Ferryboat

## Is Reconsidering Straight Diesel and Diesel-Electric Layout Bids for Vessel for New York-Governor's Island Service

THE War Department has just issued specifications for the construction of a double-ended steel Diesel ferryboat for use at Governors Island, New York Harbor.

This is the second design for this vessel, as the bids submitted on the original design December 10, 1926 at Governors Island (see MOTORSHIP December, 1926), represented a range of prices beyond the Congressional appropriation made for the construction of the vessel. Following this, the Bureau of the Budget ruled that, as funds for this purpose were provided by special Congressional appropriation, the amount required for building the boat should not be added to by funds derived from other sources. It was therefore decided that the boat should be redesigned on somewhat smaller dimensions and power in order that new bids should come within the appropriation.

Contractors for the vessel need not be located immediately in the vicinity of New York City, as the government will accept delivery at the builder's yard, and the voyage to New York will be undertaken by the government crew to be placed on board.

The original specifications called for Diesel, Diesel-electric, as steam layout. The new specifications omit steam.

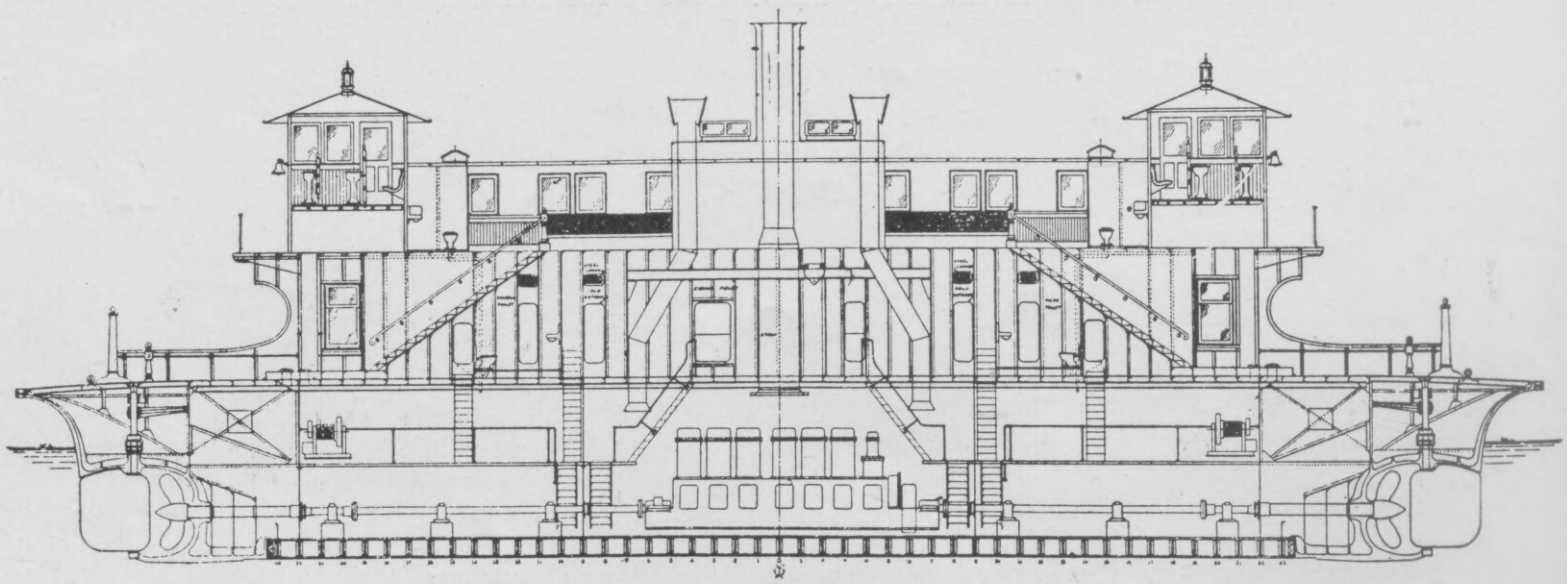
### Characteristics of New Army Ferryboat

| | |
|---|---|
| Length over guards | 128 ft. 0 in. |
| Length on 9 ft. 6 in. w.l. | 118 ft. 8 in. |
| Breadth over guards | 44 ft. 0 in. |
| Breadth of hull on 9 ft. 6 in. w.l. | 34 ft. 0 in. |
| Depth of hull at side, molded | 14 ft. 6 in. |
| Depth of hull at center, amidships | 15 ft. 2 in. |
| Draft in light service condition | 8 ft. 6 in. |
| Power (about) | 400 s.hp. |

For direct Diesel drive the main engine will be a single- or double-acting, 2 or 4 cycle, airless or air injection, marine Diesel of 4, 5, 6, or 8 cylinders designed to give about 400 hp. at normal propeller revolutions. The cylinders must be of such size as to permit of the development of the required horsepower at normal piston speed in feet per minute and with a mean effective pressure within practicable ranges for existing practice.

As the run on which this ferryboat operates is short and crowded, it is important that the reversing gear adopted should be capable of quick reverse by mechanical means under positive control of the pilot, and must be so designed that it can be coupled in with the control apparatus from the pilot house, whether the connections are by direct mechanism, electric, pneumatic, or hydraulic. Construction must be such as will permit of ready manipulation of the engine by the pilot in response to his requirements to go ahead, to stop, or to back, and the control of the speed of engines must also be in his hands.

For Diesel-electric propulsion, there will be two Diesels driving 150 kw. generators, and 20 kw. exciters. The generators in turn drive electric motors on the propeller shafts, each motor being rated 375 hp. the propeller shafts being independent each from the other at other end of vessel. As an alternative plan the generators can deliver to one motor, built on a single and continuous shaft through the boat, with a propeller at each end.



*Specified arrangement of new Diesel ferryboat for the War Department for New York-Governor's Island Service*

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# Twin Screw Tunnel Stern Motorship

## Ms. Betty, Designed for Tropical Service, Presents New Ideas and Comparative Suggestions In Western River Navigation

### By Thomas D. Bowes, M.E.

CONSTRUCTIVE thought on the problems of navigation on some of the less "easy" of the Columbian rivers has resulted in a motorship, screw propelled with screws working in tunnels. This ship is well worthy of the attention of people interested in Western Rivers navigation. It is a remarkably interesting and important shoal draft vessel.

In the United States of Columbia transportation facilities are in a crude state of development. The total milage of railroads in Columbia is not much over 1000 miles and such railroads as are there are used more as connecting links between the rivers. The rivers form the principal means of transportation. The Magdelena with its branch Cauca is the principal transportation and distributing river, the Atrato and the San Juan adding their share.

The Atrato and the San Juan Rivers, one flowing into the Atlantic and the other into the Pacific have their sources very close together. In this locality the South American Gold & Platinum Co. have their platinum dredging operations. They have built a large hydro-electric plant at the source of the San Juan for developing power, which is transported by high tension lines to their large dredges located at the head of the San Juan and Atrato Rivers. It is necessary to transport into the interior supplies for the power house, the dredges and the men at these camps, and the original vessels provided for this work were stern wheel steamers and barges.

SAN FRANCISCO, last of the stern wheel steamers was fabricated by the Treadwell Construction Co. at Midland, Pa., and shipped to the Panama Canal Zone where the final assemblying and riveting was done. These stern wheelers carried, with the barges they pushed and towed, all of the material necessary for the construction of the large hydro-electric plant.

*Ms. Betty, a smart little river and coastwise freighter and passengership specially designed and built at Midland, Pa., for Columbian waters*

#### Characteristics of Ms. Betty

| | |
|---|---|
| Length overall | 84 ft. 0 in. |
| Length on w.l. | 82 ft. 0 in. |
| Beam molded | 18 ft. 6 in. |
| Depth molded | 6 ft. 6 in. |
| Draft, light | 2 ft. 8 in. |
| Power | 160 hp. |
| Bunker capacity | 2000 gal. |
| F. w. capacity | 600 gal. |

The vessels necessary for this work were all of a very special character as they not only had to be very shallow in draft but had to have sufficient power and great handling ability to enable them to negotiate the many rapids and fast currents of these rivers. In the 250 odd miles they go up these rivers, they have continually to rise to the higher ground where the dredging operations are located.

The vessels had to be so constructed that they were extremely light and very strong. These rivers drop several feet in a short time and if a vessel gets out of the very narrow channel, she may easily become stranded and left unsupported by the water with cargo aboard. For this reason the hogging chain type of stern wheeler were not as successful as the later bridge girder types, and as the source of fuel supply became less convenient, due to the trees being chopped back farther and farther from the banks, it was thought advisable to develop another type of boat.

About 2 years ago it was decided to build an experimental 50 ft. Diesel tunnel stern tow boat and handle some of the barges in this manner. This boat was equipped with a Mianus Diesel and was built by Robert Jacob, of City Island, from the author's design. This boat proved quite successful in handling the river end of the situation.

It was then decided to go a step further and produce a boat of somewhat similar

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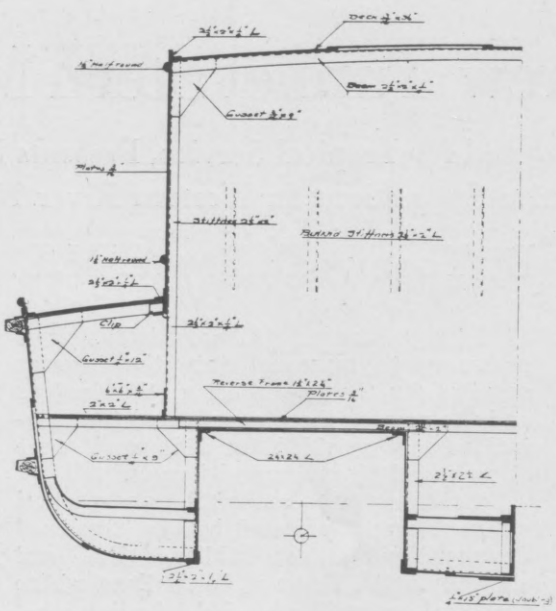
shape but capable of outside, short sea runs and in this manner cut out the boats that picked the cargo up at the Canal Zone and brought it to the mouth of the Rivers.

To meet this requirement, the author was commissioned to design a new boat. The conditions this boat was to meet were as follow:

She was to be able enough to make the runs from either Panama or Colon to Quido or Buena Ventura with cargo aboard and also was required to have accommodations to carry several passengers up the rivers.

Her draft from the Canal Zone to the rivers did not matter but she had to be so designed that as she went up the rivers and discharged her cargo, the draft became less and less, so that at the end of the run she could carry 20 tons of cargo on a draft of about 3 ft., with fuel oil and supplies enough aboard to take her back on the return trip.

She had to be fast enough to negotiate the rapids in the rivers, shallow enough to



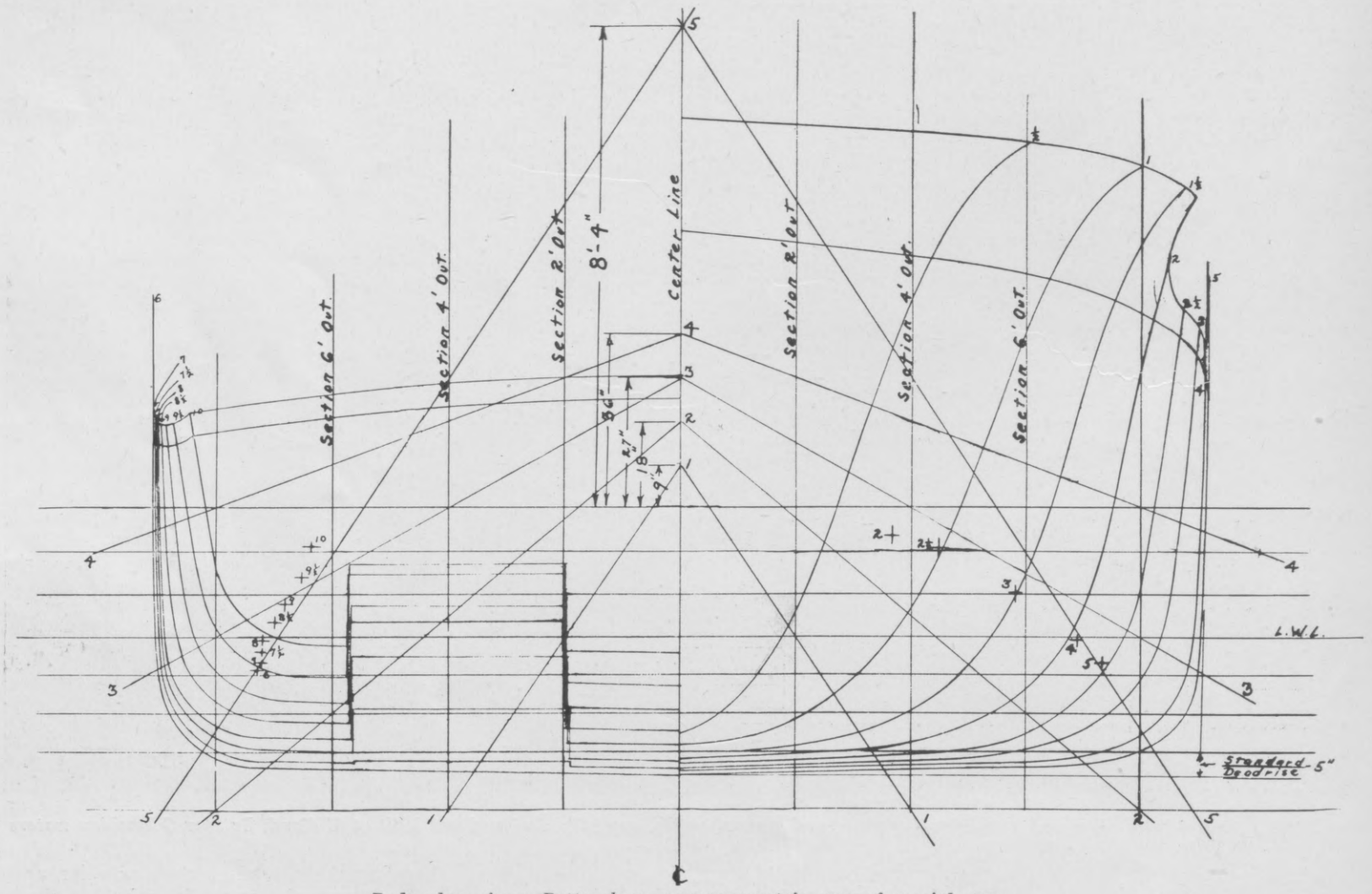
*Section in way of tunnel stern*

pressor so that it is possible, with the batteries charged up, to build up sufficient starting air for the main engines and the auxiliary engines in case of trouble in starting.

An electric-driven fuel transfer pump was provided so that the overhead daily service tanks could be kept filled and the supply of fuel oil then fed by gravity to the high pressure pumps on the motors. There was also a duplicate pump in this installation.

A large electric driven bilge and fire pump of Blackmer type was also provided and piped so that it could be used for circulating water on the main engines in case of necessity and also for cooling them down after a run. The main engines were also each provided with a bilge pump in addition to their circulating water pumps. Brown pyrometers and temperature alarms were also provided on the main engines.

For the handling of the cargo, a single mast and derrick boom capable of handling




*Body plan of ms. Betty shows arrangement in way of special stern*

go up a very low river and to combine this with ability to make the 400 miles sea trip between the rivers and the Canal.

Ms. BETTY was finally designed and the contract for her construction awarded to the Treadwell Construction Co. at Midland, Penna., who undertook the whole contract, including the installation of the machinery.

The construction of necessity had to be very light and all the plating had to be galvanized to withstand the quick corrosive conditions of this humid hot country.

The machinery finally decided upon was two 4-cylinder, 7½ in. by 10½ in. Bessemer Diesels with Maxim silencers. For the auxiliary machinery, a 6 hp. Hill Diesel set was decided upon with a General Electric generator and an Ingersoll-Rand compressor. These units are mounted on the same base with the engine and driven by a Whitney chain drive with a clutch on the compressor. The main engines are also equipped with compressors.

A special switch board was designed for this vessel and built by the Smith Meeker Engineering Co., of New York City, so that the various electric driven auxiliaries could be handled either direct or through a bank of Edison storage batteries provided in conjunction with an electric com-

from 6 ton to 8 ton loads was provided with an electric hoist especially built by the American Engineering Company, somewhat similar in design to their electric steering gear unit. The steering gear and the main windlass are of the hand type.

A study of the arrangement and construction of this boat is well worth while for anyone having similar conditions to meet. A raised forecastle head provides accommodations for the crew, and, at the same time, adds greatly to the vessels sea ability. A raised "island" amidships is used to give ventilation, room for the overhead tanks and strength to the vessel. Aft,

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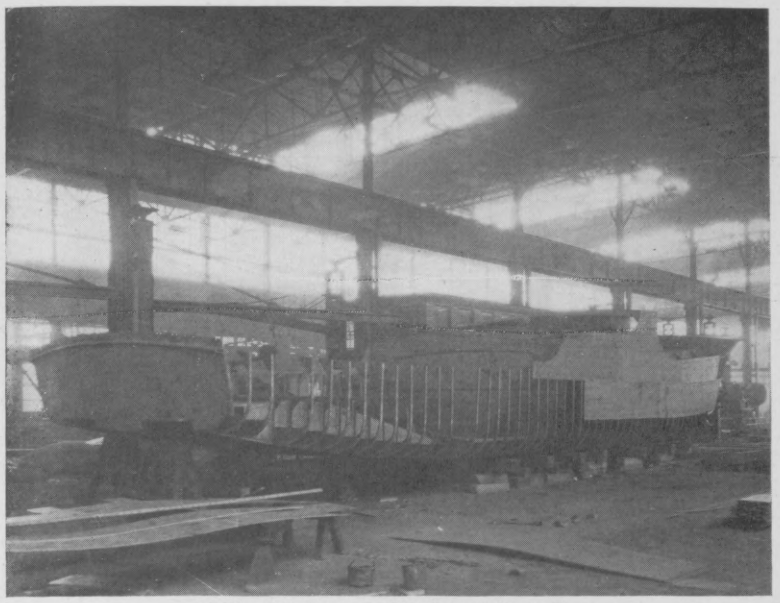
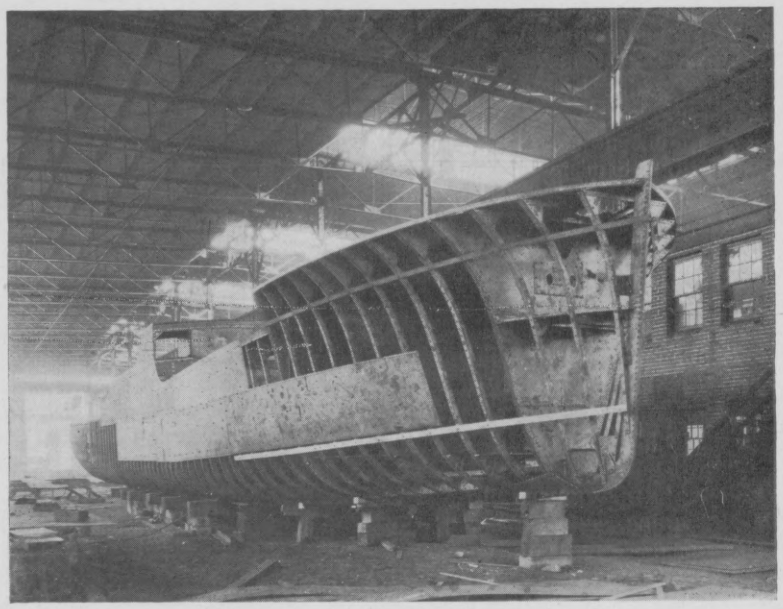


*Ship in frame showing aft end*



*Ship in frame showing forward end*

a cabin trunk is provided with storm shutters. In this are located a state room for the captain, and a stateroom for the engineer, a ward room with eight folding berths of the Rome type for passengers and a bath room with a shower. Large fresh water tanks are provided on each side of this house under the deck. Fore and aft peak trimming tanks were provided so that the vessel could be in the best possible trim to meet the conditions both outside and on the rivers.

In the construction, it will be noted that the coaming for the cargo hatches, which are located both fore and aft of the machinery space, are so designed that they act as structural members of the hull.

The type of tunnels used in this boat have been the result of long study and experimental work and have proven to be very successful and everything that could be desired in their action.

Ms. BETTY was tried out on the Ohio River last November before she left for South America. On the trial run in the Ohio River, this boat with about 30 tons of cargo, her fuel oil tanks filled, fresh water tanks filled and a considerable amount of the supplies for her trip to South America aboard, with the after peak tank filled, maintained a speed of over 11½ statute miles per hour in water of 7 ft. depth and less. She went through the water very smoothly without squatting and carried practically no following sea and handled extremely well. She is equipped with two specially designed rudders, one in each tunnel. The location and shape of these rudders is a very important item in the success of this vessel. The propellers have 38 in. diameter and 40 in. pitch. They are each 3 blade units.

Appearance of the Ms. BETTY has been favorably commented upon as it is quite different from that of the average vessel of this size and it would seem that large vessels of this general type should have quite a future in the Tropics.

In service, this boat not only carries supplies to the South American Gold & Platinum Co. but carries supplies for other companies up the rivers and brings back the platinum in a chrome nickel steel safe, built into the vessel. She also gathers up coffee and other cargo for export.

Ms. BETTY is registered under the Columbian flag. She made the trip from Midland, Penna. on the Ohio River by way of New Orleans, to the West Indies, to Panama Canal and to Buena Ventura.

# Motorships Gaining—Says Lloyd's Register

MOTORSHIP construction made a sharp gain during the first three months of this year, says the quarterly statement just issued by Lloyd's Register of Shipping. A total of 266,000 gross tons in excess of the total for the previous quarter is reported by Lloyd's as under way. Italy, which has been active in building this type of vessel shows a decrease of 28,000 gross tons; but this was much more than offset by a gain of 194,000 tons for Great Britain and Ireland, and of 100,000 tons for the other countries combined. Of the latter, Germany is now building 177,909 tons. A comparison of motorship tonnage under construction during the last two quarters shows that for quarter ending March 31, 1927, a world total of 1,172,178 gross tons was building, compared with a world total of 905,675 gross tons for quarter ending December 31, 1926.

Of ships under construction in the world at March 31 of this year, motorships represented 1,172,178 gross tons as against 1,397,686 gross tons of other types. This means that practically 50 per cent of the world's constructing is Diesel-driven. Actually the totality of maritime countries other than Great Britain is devoting considerably over 50 per cent of its merchant shipbuilding programme to motorships. British yards show the smallest motorship-building returns.

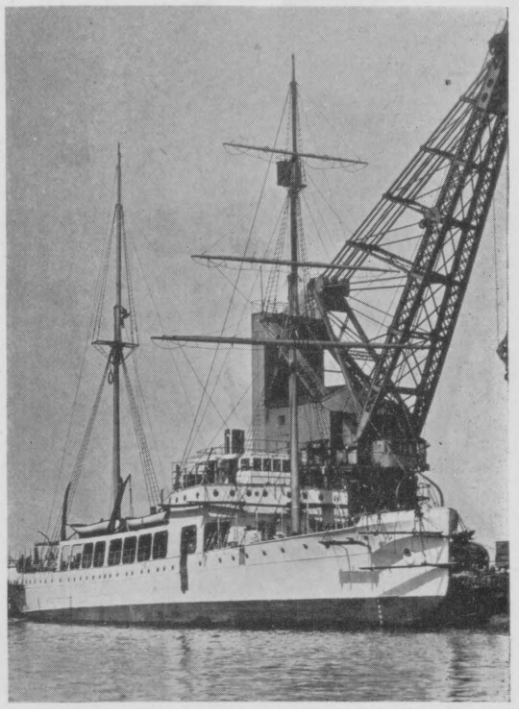
Lloyd's Register also gives returns showing the power of various types of marine engines being built or installed throughout the world. The indicated horse power of oil engines shows an advance from 843,617 at December 31, last, to 918,536 at March 31 of this year.

## Diesel-electric Coast Guard Cutter

Coast Guard Cutter, NORTHLAND, has been completed and ran dock trials last month. This vessel is one of the most remarkable vessels for government service constructed during recent years. She has Diesel-electric propulsion, with two 600 hp. McIntosh & Seymour Diesels, driving two 410 kw. G. E. generators and two 75 kw. exciters. These supply current for one 1000 hp. double armature main propelling motor.

The vessel is designed for service in the Arctic, and has, on this account, a specially constructed and well-finished hull. Her duties are particularly arduous, and it speaks well of the confidence of the Coast Guard in Diesel engines that this type of propulsion should be selected

Ms. NORTHLAND relieves the old Coast Guard Cutter BEAR built in 1874. A very complete article dealing with the old BEAR describing the new BEAR—now NORTHLAND



*Coast Guard Cutter Northland fitting out*

was published in MOTORSHIP March, 1926.

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# Indicating Hp. Without the Planimeter

## Use of an Integrator Instead of an Ordinary Indicator Saves the Labor of Planimetering the Cards

By Dan McKay*

IN Hamburg, Germany, in 1923, when the mark was at a low rate of exchange I purchased a Maihak engine indicator with power integrator. Before expending my hard earned cash I made several inquiries as to the best instrument obtainable, and several German Diesel engineers advised me that the Maihak had no peer. Hence my choice. In 3 years' use I have not had a single occasion to regret it, and especially am I glad that I got an indicator with attached integrator.

This instrument gives the i.hp. or m.i.p., whichever desired, by the simple reading of an attached dial, which in conjunction with a constant stamped on the integrator frame and with the individual engine constant readily gives the desired result without any series of complicated computations.

### Saves Labor and Time

Using an integrating indicator and a slide rule it is never necessary to leave the engine room to compute the total horsepower, and it is possible to time and balance the engine correctly in less than one-third the time needed when ordinary cards are worked out with the laborious system of planimetering. These advantages are of essential value in checking the engines under the same load conditions, and sometimes eliminate the necessity of retaking cards on some finer day if a sudden storm blows up and the engines race slightly or slow down and labor due to head winds.

I have used this instrument on five different makes of engines and have checked the readings against planimetered cards taken with an ordinary Maihak indicator, and always the difference has been so slight as to be negligible. I consider that whatever discrepancy has been shown has been due to my manipulation of the planimeter.

*Licensed Chief Engineer, unlimited tonnage.

The dial readings being obtained by the combined action of the movement of the indicator piston and of the stroke of the reducing motion, it is apparent they are proportional to the work performed on the engine piston during the time the integrator is in operation and therefore proportional to the horsepower of the corresponding engine cylinder.

### Integrator Mechanism Is Simple

A brief review of the principles and mechanical construction of the instrument will help to an understanding. Fundamentally, the power readings are obtained by continuously adding up the varying pressure on the engine piston during the piston strokes. This is achieved by a disc moved along a shaft in exact ratio to the pressure exerted upon the indicator piston and rotated by a friction plate in strict correspondence with the movement of the reducing motion of the indicator. Consequently the travel of the disc is the result of two movements:—

1st—its movement along the shaft due to varying pressure in the engine cylinder and

2nd—its rotation due to movement of the engine piston.

Thus the disc, which is geared to the dial meters, travels elliptically over the friction plate, and the unit dial meter registers positively for the power strokes and negatively for the idle strokes, the net reading on the dial denoting work done in the engine cylinder during the time-interval between the counter readings.

As the work performed on the engine piston is measured by the product of the length of stroke and the difference between the mean pressure of the power strokes and the mean pressure of the idle strokes and as the movements of the disc are in exact relation to this product, the net movement of the disc is directly proportional to the work. Power being the rate of doing work, the movement of the disc per unit of time is proportional to the i.hp. of the cylinder to which the indicator is attached.

Figs. 1 and 2 show the essential features of design and arrangement of the Maihak power integrator. It will be observed that the instrument differs from the Maihak standard indicator only by the enlargement of the base and by the addition of the necessary gear for manipulating the integrator. A short light lever transmits the motion of the indicator piston to the disc, pushing it to and fro along the shaft. The friction plate which turns the disc is driven through gears by the indicator drum. By means of worm and spur gearings, the movement of the disc is transmitted to the counter mechanism and can be conveniently read off from the dial.

### How to Use the Integrator

The integrating type of indicator can be used either as a power integrator or as a plain indicator. I generally attach a card and trace a diagram during the operation of the instrument, keeping it for reference or for use as a check against the hp. computed by integrator and constants. The counter can be disconnected when desired by turning it a few degrees on its axis.

The integrator is allowed to operate for any desired interval, then time and counter readings are again taken simultaneously. Whenever the indicator motion is changed,

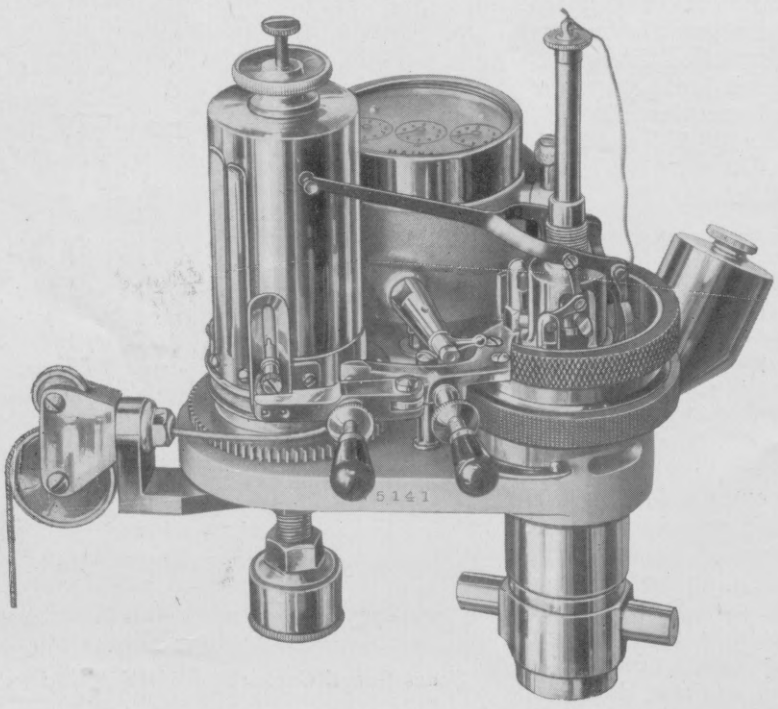


*Fig.* 1. *Shows general layout of Maihak indicator*

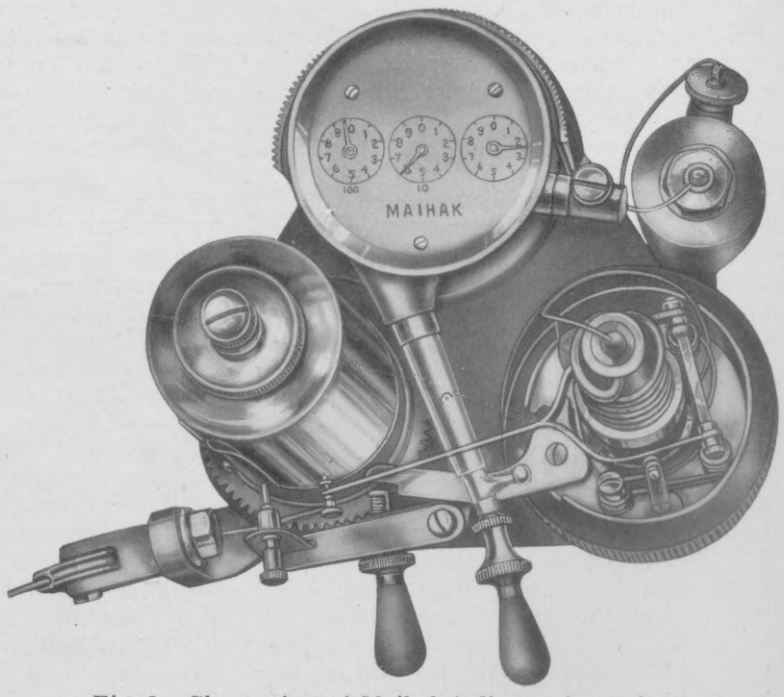


*Fig.* 2. *Shows view of Maihak indicator from above*

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at least one diagram must be taken to determine the length of card.

The dial counting mechanism may run either forward or backward, depending on the arrangement of the indicator, but since only the difference of the counter readings is used, this does not matter. It is not necessary to take the readings of a revolution counter or stroke counter in order to find the indicated horsepower.

### Finding Indicated Horsepower

Calling T—time in minutes during which the integrator is in operation
D—difference of counter readings for the time interval
S—length of indicator diagram in inches as measured from the check diagram
C—integrator constant, stamped on the integrator frame
M—actual scale of the indicator spring, i.e., 1 in. motion of the pencil produced by a pressure of M lb. per sq. in.
A—net area of the engine piston in sq. in. (deducting area of piston rod, if crank end of cylinder of double-acting engine is being indicated.)
L—length of engine stroke in feet.

$$\text{Indicated horsepower} = \frac{C \times D \times M \times L \times A}{33000 \times T \times S}$$

The number of revolutions does not appear in the formula, hence it is alike correct for 2-cycle and for 4-cycle engines. The i.hp. is of course only that developed by the cylinder end which has been indicated. For finding the total hp. of an engine all cylinder ends must be indicated.

Simplification starts here, because for a particular engine the only variables in these formulae are *D* and *T*, and if the reading of the integrator be taken for 1 min. then *T* becomes unity and the only variable will be *D*.

On the same engine the factors *A* and *L* remain always the same, and once the factor *S* is measured it will not vary for each cylinder. The spring scale *M* will not be changed, and of course the integrator constant *C* is permanent. If *T* is made equal to unity, then

$$\frac{C \times M \times L \times A}{33000 \times T \times S} = K \text{ (constant)}$$

thus reducing the power formula to the simple form:—

$$(1) \quad \text{i.hp.} = D \times K$$

That is to say, all one has to do is to take the difference of counter reading in 1 in. and multiply it by *K* to find the horsepower

*Example*:—
Cylinder diameter = 32 in.
Stroke of engine = 60 in.
Integrator constant = 15.
Length of diagram meaured = 3.66 in.
Spring scale = 400 lb., piston 1/1
Counter reading at start = 732.4
Counter reading at finish = 729.5
Time interval = 1 min.
Length of diagram measured = 3.66 in.
Type of engine, 4-cycle.

The constant *K* for this engine will be always the same if the difference in counter readings be always read for an interval of 1 min.

$$K = \frac{C \times M \times L \times A}{33000 \times T \times S} = \frac{15 \times 400 \times 5 \times 804.25}{33000 \times 1 \times 3.66} = 200$$

Therefore to determine the horsepower from the difference in counter readings above, 732.4—729.5=2.9, we have only to use the formula.

$$\text{I.hp.} = D \times K = 2.9 \times 200 = 580$$

### Finding Mean Indicated Pressure

The m.i.p. being the mean pressure acting on the piston over the entire cycle of operation of the engine, it is found by dividing the net area of the indicator card of one complete cycle by the actual card length. The power integrator automatically adds up the area of all cards which would be obtainable during the time of its operation, and the card area of one cycle is therefore obtained by simply dividing the net dial reading by the number of cycles occurring during the time the integrator is in operation.

If the dial operates 1 min., the net reading has to be divided by the number of engine cycles per minute. A 2-cycle single-acting engine has one working stroke per revolution; hence the number of cycles per minute is equal to the number of r.p.m. A 4-cycle single-acting engine has but one working stroke in 2 revolutions; hence the number of cycles is equal to one-half the r.p.m.

To calculate the m.i.p. from the net reading of the dial the following formulae are employed:

If P = mean indicated pressure in lb.per. sq.in.

N = number of revolutions per minute

$$P = \frac{C \times D \times M}{N \times T \times S} \text{ for 2-cycle engines}$$

$$P = \frac{2 \times C \times D \times M}{N \times T \times S} \text{ for 4-cycle engines}$$

The factors C, M and S are constant, and if T (the time interval) be kept always equal to 1 min. the formulae can be simplified thus:—

$$(2) \quad P = \frac{D}{N} k_2 \quad \text{and} \quad P = \frac{D}{N} k_4$$

$$\text{where } k_2 = \frac{C \times M}{S} \text{ for 2-cycle engines}$$

$$\text{and } k_4 = \frac{2 \times C \times M}{S} \text{ for 4-cycle engines.}$$

$$\text{For this engine } k_4 = \frac{2 \times 15 \times 400}{3.66} = 3278$$

(This can be used for all future calculations of m.i.p. on the same engine)

Therefore,

$$P = \frac{2.9}{95.7} \times 3278 = 99.2 \text{ lb. per sq. in.}$$

### Integrator Results v. Indicator Results

The following are actual results obtained by checking the integrator hp. against the hp. obtained with an ordinary indicator and a planimeter.

By Cards Total = 2443.7 i.hp.
By Integrator Total = 2428.0 i.hp.
Difference 15.7 i.hp.

**Single Screw Ms.—One 220 i.hp. Engine**

| | Planimeter | Integrator |
|---|---|---|
| Cyl. 1 | 54.2 i.hp. | 53.0 i.hp. |
| Cyl. 2 | 53.4 " | 53.2 " |
| Cyl. 3 | 56.1 " | 55.1 " |
| Cyl. 4 | 55.0 " | 54.3 " |
| By Cards | Total = 218.7 i.hp. | |
| By Integrator | Total = 215.6 i.hp. | |
| Difference | 3.1 i.hp. | |

**Single Screw Ms.—One 970 i.hp. Engine**

| | Planimeter | Integrator |
|---|---|---|
| Cyl. 1 | 161.0 i.hp. | 160.1 i.hp. |
| Cyl. 2 | 160.0 " | 160.3 " |
| Cyl. 3 | 159.4 " | 158.7 " |
| Cyl. 4 | 158.3 " | 157.1 " |
| Cyl. 5 | 157.2 " | 161.2 " |
| Cyl. 6 | 163.0 " | 157.3 " |
| Total | 958.9 i.hp. | 954.7 i.hp. |
| By Cards | Total = 958.9 i.hp. | |
| By Integrator | Total = 954.7 i.hp. | |
| Difference | 4.2 i.hp. | |

By the foregoing it will be seen that the integrator is reliable and can be depended upon to give an accurate account of itself under any circumstances. In the above examples the divergence between the two methods amounts in one case to 1½ per cent, but in the other two cases is about ½ of 1 per cent. If the readings are correctly taken the only possibility of a mistake is in the ensuing computations.

### Units for Operation of Integrator

I consider the metric system of reckoning horsepower by any method preferable, and I always convert my engine constant to a metric one and use it exclusively. It gives the same final result as would be obtained in English measure. Using a spring scale of 1 m/m in height = 1 kg. pressure per sq.cm. introduces a simplification not enjoyed by any other method, because the area in sq.mm. divided by the length in m/m = m.i.p. in kg. per sq.cm.

Time element is a vital factor in comput-

**Twin Screw Ms. Two 1250 i.hp. Engines**

| | Planimeter | | Integrator | |
|---|---|---|---|---|
| | *Port* | *Stbd* | *Port* | *Stbd.* |
| Cyl. 1 ..... | 203.0 i.hp. | 204.8 i.hp. | 202.0 i.hp. | 202.0 i.hp. |
| Cyl. 2 ..... | 202.5 " | 202.2 " | 202.0 " | 202.0 " |
| Cyl. 3 ..... | 204.5 " | 204.8 " | 202.0 " | 201.0 " |
| Cyl. 4 ..... | 203.0 " | 204.8 " | 201.0 " | 203.0 " |
| Cyl. 5 ..... | 203.0 " | 202.2 " | 203.0 " | 204.0 " |
| Cyl. 6 ..... | 205.0 " | 203.9 " | 202.0 " | 204.0 " |
| Total ..... | 1221.0 i.hp. | 1222.7 i.hp. | 1212.0 i.hp. | 1216.0 i.hp. |

*Example*:—Using the data employed in the example of the horsepower calculation just above and with r.p.m. = 95.7, the m.i.p. can be obtained directly from the formula:—

$$P = \frac{Dk_4}{N} = \frac{2.9k_4}{95.7}$$

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ing horsepower by means of an integrator, and a stop watch should therefore be used, but the second hand of any timepiece will do. The reducing motion of the various cylinders should be uniform and of a length easily divided, e.g. 100 m/m or 2 in., 3 in., etc. Note the unit dial counter reading or set it to zero by hand. Open the indicator cock simultaneously with the release of the stop watch. One to five minutes is sufficient, having in mind that the instrument must be applied to all cylinders at constant engine revolutions, because any variation of engine speed will affect the final counter reading.

The integrator indicator is applied in the usual manner to the indicator cock, assuming that the instrument was thoroughly cleaned and oiled subsequent to its last application and that the indicator cock has been well blown out before attachment. It is always advisable to obtain an actual diagram with a carefully drawn hand line to check timing. After this has been adjusted to suit, shut off the indicator cock and remove the indicator piston.

If the indicator piston needs cooling, insert it in a Penn oiler which has had its spout removed and is half full of clean oil. This will effectually cool it quickly. If you have no liner swab make one in the lathe out of hardwood or by hand if you have no lathe. Take a piece of wood 3 in. long just large enough to enter the liner, turn down a suitable handle, recess the stock for about 1 in. and wrap it with a few turns of Berlin wool. You will have a fine liner swab. Open the indicator cock and blow all particles out of the liner, then swab it out and replace the indicator piston. See that the oiler is well filled and the instrument is ready for service for any length of time.

Proper care and attention will insure the long life of any indicator. Such amateurish signs as bent pencil arms, dented drums and sticky pistons are inexcusable.

### Self-Oiling Feature

A special and admirable feature of the Maihak power integrating indicator is a self oiling attachment for keeping the piston and liner properly lubricated during continuous operation of the instrument. If the indicator is properly cleaned prior to application there will never be any danger of a sticky piston during the time the indicator is in use, and a smooth even diagram is assured. Just before discontinuing the use of the indicator take the test card. This is an accurate method of determining that the integrator has been working properly.

I recommend Vacuum Heavy X as a good indicator oil. Texaco Ursa also gives satisfactory results. Beware of so-called indicator oils which disappear after one or two revolutions of the engine.

Constructional features and principles of the self lubricator are herewith explained.

Sleeve *A* rests at the lower end fairly tight on the tapered seat of *B* of cylinder frame. The piston always covers the oil hole *C*. A small fraction of the operating pressure is carried into the space between the sleeve and the outer cylinder due to clearance at the lower end of the sleeve and between the piston and the sleeve. Pressure in the space changes in phase with the engine cycle, and difference between the pressure in the space and the force of gravity of the oil in the cup automatically controls the check valve *D*. During the compression stroke the pressure in the space rises sufficiently to overcome the gravity of the oil and drive the ball *E* to the right. During the exhaust and suction strokes the pressure in the space drops to that of atmosphere and the weight

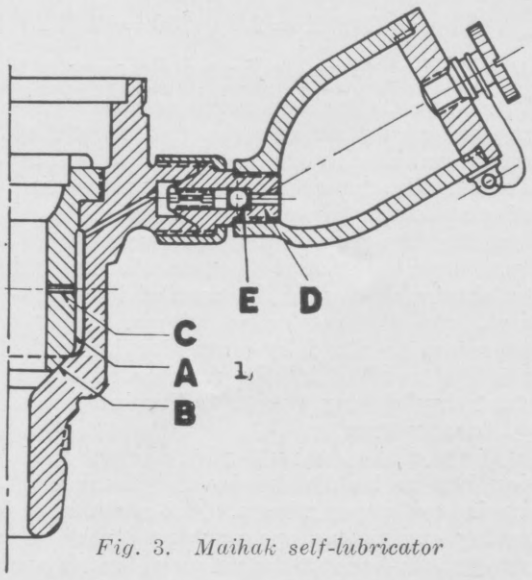



*Fig. 3. Maihak self-lubricator*

of oil forces the ball to the left. While the ball is floating in oil the charge passes through the valve and is uniformly spread over the piston through oil holes in the sleeve or liner.

### Every Indicator Needs Care

The indicator as used by some people is of no more use than none. If a man cannot learn to keep his instrument in good order and use it intelligently I would advise him not to use an integrator. No instrument will give results if not properly cared for. Those who take diagrams that look like the map of Nova Scotia and use an indicator like they use a monkey wrench will get no better results from the integrator than they have been obtaining from an indicator. In my estimation the engineer who leaves an indicator lying under a bunch of rags in the log desk or storeroom should throw it overboard and then jump after it. A good riddance to an abused instrument and a careless mechanic. Uniform diagrams cannot be obtained with dented drums, bent pencil arms or worn liners. If you are good to your indicator it will be the same to you and give you the results that were desired when you or your employers expended their money in the hopes of getting better results out of the old plant.

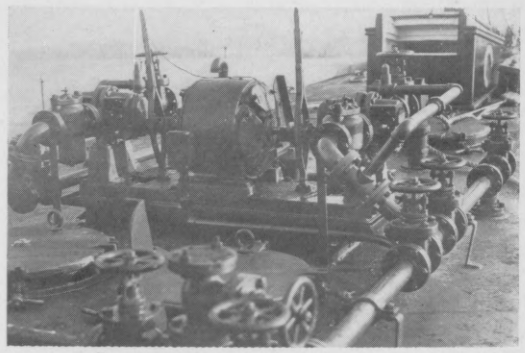
The United States representatives of the Maihak power integrator and indicator are anxious to co-operate with the owners of these instruments so that they may obtain the best results.

# New Socony Delivery Barge

MUCH new thought is exhibited in the design of NEW LONDON SOCONY, a barge specially constructed for Standard Oil Co. (N. Y.) and designed by W. D. Fletcher of the Construction and Repair Department S. O. Co.

NEW LONDON SOCONY is 64 ft. 10½ in. long, 15 ft. 6 in. beam, 7 ft. 6 in. draft and her 75 hp. 3-cylinder direct reversible Standard engine gives her a speed of 8¼ knots loaded. NEW LONDON SOCONY is used for delivery of refined oils from New London to Block Island and other coast points. In her runs out in the open the ship frequently encounters heavy weather and her success is a tribute to the dependability of the Standard engine.

The hull has been constructed of wood, but the cargo oil tank is of steel and is so constructed that it can be lifted clear of the hull for inspection, repair, or replacement.



*Cargo pumps arranged on deck*

*Ms. New London Socony, a new Diesel delivery barge operating on Long Island Sound*

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# High Pressure Air System Fittings

## Perfect Service from High Pressure Air and Water Systems on Motorships Depends Upon Careful Selection of Materials

By E. Prostrednik, M. E.*

IN both fresh air and salt air service on a motorship copper piping will outlast steel because of its greater resistance to all forms of corrosion. Naturally, this advantage will be more marked in salt air service. Copper piping will cost more than steel piping, though the labor of installation will be approximately the same. There is no essential difference in making up joints or in keeping them tight, though there is a slight advantage in favor of copper as regards tightness due to the more ductile character of the metal.

For air service where moisture and contamination is present, the durability of copper due to its greater resistance to corrosion will be more marked.

The size of the piping has no effect upon its service, as long as sufficient thickness of wall is present, so that there is enough metal left at the base of the thread in screwed fittings, to withstanding pressure equally.

For pressure not exceeding 300 lb. per sq. in. screwed fittings can be used. For 800 lb. per sq. in. screwed fittings should be used only on pipe sizes below 2 in. For sizes over 2 in. flanged joints should be used. All fittings used in copper pipe installations should be bronze.

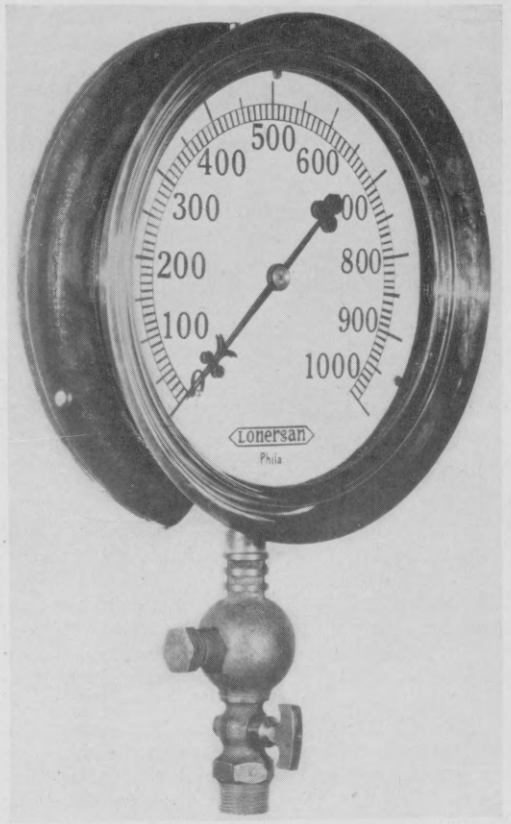
Gauges are of great importance on all air pressure lines and should be located as near the point where pressure is to be held as possible to give accurate readings. The further away the gauge is located, the more pipe and fittings are required; naturally, friction is set up and the readings are not 100 per cent accurate.

Gauges located on one board or at the control platform form the ideal installation and must be left as a matter of good judgment.

Gauges should always be selected for the purpose they will be required. The size should be in keeping with surrounding conditions. The large gauges give clearer readings, but the weight of gauge and place it will be used must be the governing factor. A 6¾ in. or or 8½ in. diameter dial gauge is good for most uses.

The type of pressure or vacuum gauge to be used depends on requirements. A single spring gauge is most practical on pressures up to 100 lb. and a double spring gauge for pressures over 100 lb. A small size gauge may need no support whatever if there is no length of piping and no vibration is evident. A beaded back case can, therefore be used, but where a large diameter gauge is used and a support required, a gauge with a flanged back must be used so that it can be fastened to a solid support. The matter of support is very important and where possible every gauge should be made fast.

A gauge set up on the end of a vertical pipe with no fastening whatsoever is bound to quiver or vibrate, and no gauge can stand excessive vibration without wearing the internal parts and giving false and incorrect readings. Always fasten gauges on a board, and where impracticable to install a gauge board fasten gauges to some solid upright or build brackets to make gauge installation rigid.




*Gauge for high pressure work*

A question as to distinguishing colors of gauges to conform with the color scheme of pipe lines is one that may receive attention from engineers who like to have polished brass gauge cases and rims. It is the contention of the writer that distinguishing colors of gauges might be practical but would not be a sight pleasing to the eye where a great number of gauges of varied colors are mounted on one board. A mark showing service of gauge should be stamped on the face of dial and if practicable a service plate fastened directly under the gauge.

Gauges for air pressures should have a telltale or maximum red hand for the purpose of marking the working pressure and taking the responsibility from the shoulders of engineers who must carry requirements in their heads where gauges are not marked.

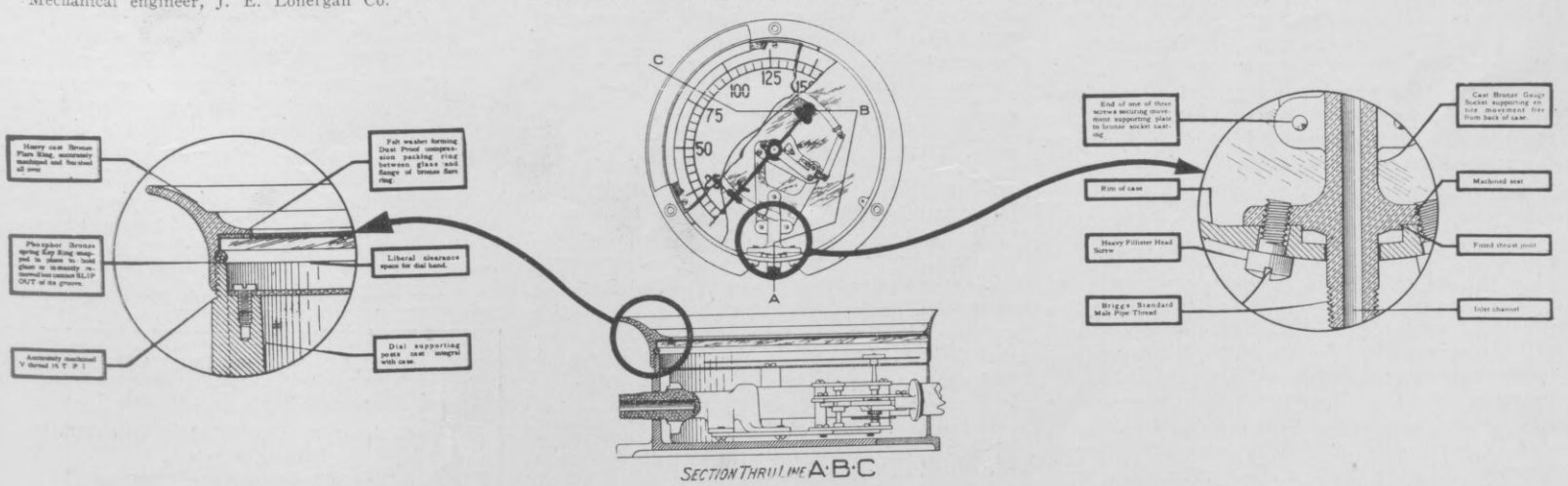
A gauge is an instrument of precision and must at all times be handled with care. The working parts are few and require little care and attention aside from a little oil occasionally. A gauge should be tested and calibrated according to its use. A gauge that has continuous action of movement of hand back and forward needs more attention than one that has a constant pressure exerted on it. But, all gauges must be calibrated for accuracy regularly; calibrating once a week is not too much where absolute readings are essential. A test gauge connection located below the gauge makes it easy for the engineer to check up the accuracy of a gauge in use.

A gauge must never be dropped or given a sudden blow, as rough handling is detrimental to this frail but important piece of mechanism.

Important points in the selection of a gauge are the quality of workmanship and material. The first should be the best and second must be free from all defects and blemishes which affect serviceability and appearance. Cases and bezels should be of heavy red brass, polished and lacquered, cases threaded to take screw bezels. The composition should consist of at least 80 per cent copper with suitable mixture of tin and zinc.

Bezels must be rigid, properly threaded, and screwed to case. The glass must be clear and free from blemishes, and secured to the bezel with a felt gasket and split snap ring so as to exclude dust and moisture under usual tem-

*Mechanical engineer, J. E. Lonergan Co.


Heavy cast Bronze Plain Ring, accurately machined and finished all over
Felt washer forming Dust Proof compression packing ring between glass and flange of bronze flare ring
Phosphor Bronze spring Key Ring snapped in place to hold glass or intensify retaining but cannot SLIP OUT of its groove.
Liberal clearance space for dial hand.
Accurately machined V thread INTERNAL
Dial supporting posts cast integral with case
C
B
A
100
125
150
75
50
25
SECTION THRU LINE A·B·C
End of one of three screws securing movement supporting plate to bronze socket casting
Rim of case
Heavy Fillister Head Screw
Briggs Standard Male Pipe Thread
Cast Bronze Gauge Socket supporting entire movement free from back of case.
Machined seat
Fitted thread joint
Inlet channel

*Constructional details of a well made pressure gauge fulfilling requirements for work on motorships of all types*

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perature variations met with on ships.

Gauges should have black indicating hands and, if specified red, a fixed hand to show working pressure. Dials must be rust proof, with faces silvered and lacquered and marked with graduations and figures, cut or etched and filled with black enamel. Gauges must accurately and correctly graduated and the graduations cover an arc of not less than 270 deg.

All parts, including hairspring and connecting screws, should be of nonferrous materials. All wearing surfaces of suitable combinations of metals to assure low friction and long wear.

Arbor bearings should be deep bushed to give a bearing at least one and a half diameters long, the sector of suitable hard, nonferrous material, with cut teeth. All moving parts should be of proper metals adapted to low friction, and resigned as light as consistent with requirements.

The Bourdon tube must be soldered or screwed into the socket so that no leakage will occur, when the gauge is subjected to its maximum working pressure.

The error of reading at any point above 5 per cent of the maximum reading to which the scale is graduated, should not exceed 1½ per cent of the maximum reading to which the scale is graduated.

For operating engineers, the watchword should be, "Be careful of and take good care of the gauge for it is your best pressure insurance."

## Personal

*W. S. Hovey* has been elected president of Fairbanks, Morse & Co., the former president, C. H. Morse, becoming chairman of the board. This is the first time this position has been held by a man not of the original Morse family. Born in 1875, a graduate of Cornell, Mr. Hovey joined the Sheffield Car Co., an affiliation of Fairbanks-Morse, in 1902, as assistant superintendent. Later he became superintendent, which position he held until 1913, when

*F. S. Hovey, president, Fairbanks, Morse Co.*

he was transferred to the Beloit Works of Fairbanks-Morse as manager of the Engine Division. A few months later, saw him general manager of that plant. In 1919, Hovey was elected vice-president in charge of all the manufacturing activities of Fairbanks-Morse and in 1924, was made general manager of the entire business. His elevation to the presidency brings a man to the helm of this company who has worked his way up through the ranks. His thorough grasp of all factors of this widely extended business makes him, in the opinion of his associates, well suited for the new office. He will remain general manager.

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*Ira Short*, formerly gear engineer of the Engineering Department at the South Philadelphia Works of the Westinghouse Electric & Manufacturing Company, has been recently promoted to the position of marine engineer. Mr. Short was born in Woodville, Michigan, in 1890. He was graduated from the North Carolina State College with the degree of B.S. in Mechanical Engineering, and in 1911 entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company at East Pittsburgh. In 1912 Mr. Short was transferred to the Condenser Engineering Department, specializing on condensing apparatus as applied to marine installations. He remained in this work until 1917 when he was transferred to the Marine Engineering Department. Mr. Short continued in marine engineering work until 1923 at which time he was promoted to the position of gear engineer, continuing in this capacity until his recent appointment as marine engineer. During his work with the Westinghouse Company Mr. Short assisted in designing propulsion equipment for a number of United States Navy destroyers and merchant vessels. He also carried out considerable development work on gears. Mr. Short is an associate member of the American Gear Manufacturers Association.

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*J. J. Brown*, who for the past 9 years has been in charge of the installation and service work of marine electrical machinery for the Westinghouse Electric and Manufacturing Company, has now been appointed manager of marine service for the Westinghouse Company, with headquarters in New York.

## Merchant Fleet Services Defined

The Shipping Board Merchant Fleet Corporation has issued a booklet entitled "Trade Routes and Shipping Services in Relation to Commerce of the United States, and the Development of an American Merchant Marine."

This is a publication especially prepared for information of the American people who are the owners of and stockholders in the Merchant Fleet of the United States Shipping Board.

A graphic description of each Shipping Board Service is given, with an outline map, a list of merchant ships in actual operation, the name and address of managing operators of each line, illustrations showing the wide scope and varying activities of the several services, together with a brief synopsis of the trade peculiar to each route.

This is the first time any publication has ever been issued showing a clearly defined shipping route for each of the Government owned lines, together with an index showing the various domestic and foreign ports touched by these ships.

## Annual Report of G. E. C.

The annual report of the General Electric Company shows the year 1926 to have been the most prosperous in the history of the company. Sales billed amounted to $326,974,104, compared with $290,290.166 in 1925, an increase of more than $36.000.000. The best previous high record was in 1924 when sales totaled $299,251,869. Orders received during 1926 amounted to $327,400,207, an increase of eight per cent over 1925. The previous high record was $318,470,438 in 1920.

Profit available for dividends on the common stock on the 1926 business was $44,314,884, equivalent to $6.14 per share on the 7,211,481 shares of no par value stock outstanding, as compared with $20.49 per share in 1925 on the 1,802,870 shares of $100 par value common stock then outstanding, which is equivalent to $5.12 per share on the present stock. In August, 1926, four shares of no par value common stock were issued in exchange for each share of the old common stock.

This split-up of shares is reflected in an increase in the number of stockholders from 36,697 in December, 1925, to 46,305 in December, 1926. More than 98 per cent of the stock is held in the United States and nearly half of the stockholders are women.

## Cramps Discontinue Shipbuilding

The Wm. Cramp & Sons Ship and Engine Building Co. has announced that it will discontinue shipbuilding operations on the completion of vessels now in hand. With this cessation the company terminates a shipbuilding career which has included some of the world's most famous ships. The manufacturing operations of the company's important subsidiaries, including the De la Vergne Machine Co., I. P. Morris Corp., Cramp Engine Manufacturing Co., etc., will be continued. These operations include the manufacture of Diesel engines, bearing metal and hydraulic machinery. The business of the subsidiaries companies is in a sound and prosperous condition and is capable of expansion.

## The Ports of Baltimore, Md., Washington, D. C., and Alexandria. Va.

*Port Series, Report No.* 16. *Issued by the Board of Engineers for Rivers and Harbors of the War Department in cooperation with the U. S. Shipping Board. Issued in three parts. Obtainable from the Government Printing Office, Washington, D. C.*

A report explaining in detail the shipping and terminal facilities at Baltimore, Washington, D. C., and Alexandria, Va., has just been completed by the Board of Engineers for Rivers and Harbors of the War Department in coooperation with the Bureau of Operations of the United States Shipping Board. This report constitutes No. 16 of a series of reports on the ports of the United States.

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As we close for press, the death is announced of Wm. Goodman, vice-president, Worthington Pump and Machinery Corp. The late Mr. Goodman was a distinguished engineer.


## Classified Advertisements

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